THE

ELECTRICAL REVIEW.

VOL. XLV. JULY 7, 1899. No. 1,128.

CONTENTS:

	PAGE
A Sub-department of State	1
Electric Tramways in London	3
The Report of the Pacific Cable Committee (*continued*)	4
The Volta Centenary	5
Condensers for Electric Light and Power Stations	6
Parliamentary Committees	6
Legal:—Hyde Corporation *v.* Oldham, Ashton, and Hyde Electric Tramways Company	10
Blackwell *v.* Greenwood & Batley, Limited	10
Correspondence:—Remarks on Extracts from a Contemporary *re* Competitive Telephony and Non-Competitive Winchester House Telegraphy	11
Wholesale *v.* Retail	11
Controllers for Traction Work	11
Business Notices, &c.	11
The Hull Electric Tramways (*illustrated*)	18
Electric Light and Traction Engines.—III. (*illustrated*)	24
Notes	26
City Notes	27
Traffic Receipts	30
Stocks and Shares	30
Share List of Electrical Companies	31
Market Quotations	32
Machine Tools (*illustrated*)	33
Power Transmission by Direct and Alternating Currents ...	34
The Electrolytic Methods of Zinc Extraction	36
Foreign Electric Machinery	37
The Calcium Carbide and Acetylene Gas Industries	38
New Patents	39
Abstracts of Published Specifications	40

THE

UNIVERSAL ELECTRICAL DIRECTORY

1899

Edition

Price 6s.

NOW READY.

H. ALABASTER, GATEHOUSE & CO.,

4, LUDGATE HILL, LONDON E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON.

Telegraphic Address: "AGENKAY, LONDON." Code A B C.

Telephone No. 988 Holborn.

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades.

SUBSCRIPTION RATES.—In *Great Britain*, Post Free per Year, 19s. 6d. To *all other countries*, per Year, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each.

READING CASES, to hold from One to Twenty-six Numbers until the Volume is complete for Binding, can now be had from the Publishers, Price 6s. or Free by Post (in Great Britain), 6s. 6d

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. *Paris:* VEUVE J. BOYVEAU 22, Rue de la Banque. *Berlin:* ASHER & Co., 13, Unter den Linden.

Cheques and Postal Orders (on Chief Office London, to be made payable to Mr H. ALABASTER, 4, Ludgate Hill, E.C.

A SUB-DEPARTMENT OF STATE.

THE members of the deputation from the Eastern and Eastern Extension Telegraph Companies which, on Thursday last week, waited on the Chancellor of the Exchequer and the Secretary of State for the Colonies, must have left the Treasury at the conclusion of the interview sadder and wiser men. The object of this deputation was to point out to the Government the unrighteousness of interference with the very profitable monopoly which has so long been peacefully enjoyed by the Eastern group of companies and their allies. It is indeed hard to be "wounded in the house of a friend," and a touching reference was made by the Marquis of Tweeddale (the chairman of both companies) to the fact that the companies had done the State some service, on several critical occasions, and that hitherto the cable companies represented had been treated by Her Majesty's Government very much as if they were a sub-department in the administration of the affairs of the Empire. To a great extent this doubtless has been the case, and the position, so profitable to the interests of the companies thus favoured, has been maintained by extremely judicious management in this connection. It must be, therefore, doubly disappointing to find the claims of an old friendship so coldly received. As regards the services afforded the State by the companies on critical occasions, we may rest quite content in the knowledge that the companies have been repaid for them, both in meal and in malt, and Mr. Chamberlain, in his remarks, while cordially recognising the general excellence of the services rendered, said that he had observed that hardly any critical situation arose at the Cape, but one or more of the cables were broken down!

Among other things, Lord Tweeddale denied the imputation that the allied companies were either monopolists, or that they charged exorbitant rates. Mr. Chamberlain, however, pointed out that instead of applying their very large earnings to the reduction of rates, the amount which might have been so used was devoted to strengthening their monopoly, which although not a statutory monopoly, is none the less a practical one. It is only owing to the rejection of the proposals which the Eastern group of companies made to the Chancellor of the Exchequer two years ago that the Government are now free to unite with the Colonies in the establishment of the Pacific cable. In March, 1897, the companies were applying not only for various subsidies but also for "an undertaking by the Governments concerned, that for a fixed period, they will not subsidise any opposition line connecting any of the places served at present by the associated companies." Had this proposition been agreed to, the competition of even a State guaranteed Pacific line would have been impossible. Instead of reducing the rates, these companies have spent very large sums out of revenue in renewals and extensions

of their cables. The Eastern Extension Company alone has paid away £1,500,000 for repairs and renewals, and the reserve funds of the Eastern and Eastern Extension Companies now stand at £2,137,000, at the lowest computation. It is a striking exhibition of the irony of events to find these companies gravely lecturing the Government on the wickedness of assisting the Pacific cable financially, or by guarantee, while they themselves, when recently advocating an "all-British" cable, *viâ* the Cape to Australia, and with a branch to Ceylon, asked for Government assistance amounting to £101,400 annually, besides a Government capital expenditure of about £50,000 for an English land-line. This scheme having collapsed, these companies are, as pointed out by Sir M. Hicks-Beach, now asking for £20,000 per annum towards another cable to South Africa.

The inefficient service to the Cape undoubtedly calls for such a cable, which, however, might well be laid without Government assistance out of the very large profits which have resulted from the existing cables to Cape Colony, which are already heavily subsidised. The amount of these profits may be guessed at, when we are told that, although the late Sir John Pender considered a gross annual receipt of £180,000, in respect of the traffic circulating by the eastern and western routes to the Cape, a fairly paying revenue, this amount, in the year 1896, was exceeded by £120,000. Besides the claim mentioned by the Chancellor of the Exchequer, the Eastern group, in the very deputation under consideration, ask the Government for a guarantee for their proposed British Imperial Telegraph Company. This group, including other companies in which they themselves are largely interested, has received in subsidies and from guarantees a total sum very largely exceeding £3,000,000, the greater portion of which has been paid to them by the Governments of England, Cape Colony, and Australasia. This assistance obviously places these associates above the risk of competition from any other unaided source, and it is owing to this position that their practical monopoly has been established and gradually extended in its scope. As regards the manner in which the companies deal with the rates, these, as Mr. Chamberlain pointed out, are the subject of very great and justifiable complaint. We know that in the case of Australia the rate was reduced from 9s. 4d. to 4s. 9d. per word, only under the pressure due to the impending rivalry of the Pacific cable scheme. We also know that the reduction was only agreed to after the Australian Colonies had promised to share in the financial loss which might arise. We pointed out last week that in the case of Indian rates, to which attention was recently called in Parliament, these companies do nothing to meet public convenience, although very well able to do so, for we gather from figures provided by the Marquis of Tweeddale, that on a message in transit from Australia to England only 1s. 4½d. per word is charged for carriage from Bombay to London, while for an Indian message the exorbitant rate of 4s. per word is charged for transmission between the same two places, although it requires only the same amount of attention. We submit that it is much more to the advantage of the English public that the excess profits of the Eastern Company should be applied to the reduction of such high rates, than to laying cables from Emden to the Azores for the benefit of Germany, and in doing unproductive work in foreign waters.

As regards the attitude of general benevolence claimed for these companies, the suggestions which we have here made might seem to be out of place were they not called for by the claims which these companies profess to have on public gratitude. We cannot find that this assumption of benevolence is at all borne out by the past history of the relations between the complaining companies and the Colonial Governments. When in February, 1886, the subsidy paid to the Eastern Extension Company by the New Zealand Government expired, and the latter hesitated to renew what they considered to be an unnecessary subsidy, the company in question, while professing willingness to give a tariff of 5s. per 10 words from New Zealand to Australia if the subsidy was continued, threatened to raise the rate to 10s. per 10 words, and 1s. for every extra word should the subsidy not be forthcoming. This, Sir Julius Vogel, for New Zealand, refused to assent to, on the grounds that the renewal of subsidy would tend to perpetuate monopoly and prevent the laying of a new line. The rates were accordingly raised and maintained until an agreement was arrived at. In the case of Queensland, which Colony for many years declined to join the remainder of Australia in paying subsidies to these companies, the rate from London to Queensland was kept at 9s. 5d. per word; although telegrams to the neighbouring Colony of New South Wales only cost 4s. 11d. per word. When, however, on July 1st, 1897, Queensland consented to join the other Colonies in assisting the companies, the rate to Queensland was at once reduced to 5s. 1d.

With all the above information before us, we can only conclude that, however much these companies may strive to obscure the issue, this cable combination can only be described as a carefully constructed and very profitable monopoly, the success of which has hitherto been due to extremely conservative management and to the absence of healthy competition.

Fire-Resisting Material.—A novel fire-resisting material is described in the *Times*. This is known as Rous's, and is said to consist of hay chaff mixed with lime, alum, tungstate of soda, and other salts of alkaline earths. It is claimed to possess a very low specific gravity, and to be adherent to iron and capable of ordinary use as plaster. Probably the porosity due to the chaff renders it a poor conductor of heat, while the resistant properties of plaster remain. The alum and soda salts no doubt produce toughness. Alum has a well-known hardening effect on both carbonate and sulphate of lime, and is used for this purpose in Keene's and other cements. Experiments are described which seem to show that the new material has considerable protective effects on timber. Would it not be desirable to try the material upon wrought-iron and cast-iron columns in a fierce fire, with heavy compressive stresses on the columns? These are the materials which are used for columns, and it is the failure of columns and beams when hot which destroys fireproof buildings. Rather softer than Keene's cements, this and other cements are recommended as a coating upon Rous's, which is stated to be effective in preventing the passage of heat through coke breeze concrete floors; these are stated by Mr. Rous to be good floors, but permeable to heat. It is also advised as a material for covering boilers and steam pipes, for which purpose it is cheaper than many substances now employed for the purpose. It is suggested that the material would form excellent linings on steam ships, to prevent the passage of heat from galleys and other working places to other parts. One cwt. of Rous's composition will cover 30 square feet to a thickness of ¾ inch, and the material will cost about 13s. per cwt., or at the rate of nearly 6d. per square foot, apart from labour, which does not appear to us to be so very cheap.

ELECTRIC TRAMWAYS IN LONDON.

ONE of the most extensive, and at the same time interesting schemes of electric tramways in London, is that projected by the London United Tramways Company. Many of our readers may remember that some months ago we set forth the various lines owned and controlled by this company, as well as the extensions and changes which were proposed. The ambitious nature of the proposals will be shown from the fact that if Parliamentary and local sanction is obtained, the tramways will comprise one vast system amounting to over 39 miles of road line, and 75 miles of track. There are already either working or under construction some 27 miles of route, and the remaining 13½ miles are being promoted at the present moment. Mr. J. Clifton Robinson, the well-known managing director of the London United Tramways, quite recently gave some interesting details of the electric system which will be employed on the West London lines; and it will be useful to refer to the principal features of the scheme. It is interesting to mention, as showing the advantage of a vigorous policy in all tramway matters, that in 1894 the system of tramways, some 8 miles in length, was known as the West Metropolitan Tramways; the company owning these lines had fallen upon evil days, and in the year mentioned the concern was practically in a bankrupt condition. It was taken in hand by a small syndicate composed of experienced directors of tramways, among whom were Mr. Clifton Robinson and Mr. George White, both of whom had acquired distinction in connection with Bristol tramways, and the extensive systems owned by the Imperial Tramways Company. Even as a horse tramway, the West Metropolitan system was completely re-organised, but the aim of the directors, and one which was never lost sight of, was to convert the whole system into electric tramways. The battle which has been fought in West London, in the cause of electric traction, is one familiar to most of us; and in fighting the vested interests of property owners, and the more or less public rights of the district councils, magnificent service has been rendered to the cause of electricity. When the lines were first acquired by the syndicate alluded to, it was re-named the London United Tramways Company, and at the commencement of the operations there were four lines. One from Hammersmith through Chiswick to Kew Bridge, which was 3 miles and 3 furlongs in length; the second from Shepherd's Bush to Acton, 2 miles and 5 furlongs in length; the third a junction line on the Goldhawk Road, connecting the two before-mentioned lines together, 1 mile and 4 furlongs in length; the fourth from Kew Bridge to Richmond, 1 mile and 5 furlongs in length, the whole system comprising a little over 9 miles in length. In seeking powers to convert these lines for electrical working the company sought at the same time to strike out into new directions. They sought powers to construct electric lines from Kew Bridge to Brentford and Hounslow, which was to be 3 miles and 5 furlongs in length; another line from Acton through Ealing and Hounslow, which was to be 2 miles and 7 furlongs in length; and a third line from Brentford northwards to connect up with Hounslow, which was to be 2 miles and 3 furlongs in length. It is sufficient to indicate the soundness of the scheme when it is mentioned that Parliament looked so favourably upon the project as to grant the necessary powers with the solitary exception of the Ealing connecting line, and that was refused merely because the District Council withheld their consent. These lines were not sufficient to exhaust the demands of the London United Tramways Company, for permission was sought and obtained from the Light Railway Commissioners to construct an electric trolley line extending from the terminus at Hanwell through Southall, Hayes, Hillingdon, and Uxbridge, a distance of some 7 miles. It was to some extent unfortunate for the company that some portion of their system lay within the jurisdiction of the London County Council, and we need hardly say that until recent times this august body has been strenuously opposing the overhead trolley system, but the opposition of the County Council only spurred the London United Tramways to fresh efforts, and by Parliamentary consent and an important light railway order they were at last able to wring permission from the County Council to convert this small portion of the tramways which entered the area governed by the County Council. It was not, however, a complete victory, for the County Council insisted that some portion of the line should be laid down as a conduit line, practically for the purpose of providing the County Council with information as to the working of this particular system of electric traction. The system when completed will provide more than an interesting example of the conduit line through a populous district, for the electrical arrangements of the trolley line itself will be unique as far as this country is concerned. It will be remembered that Prof. Rücker and other eminent scientific men offered some opposition to the West London Tramway's scheme, on the grounds that they might interfere with the very important work carried on at the Kew Observatory. It is to the credit of the promoters of the West London Tramway's scheme that they recognised the claims of the Kew authorities to be protected against the influence of earth currents, and they propose to meet the necessities of the case by boldly adopting a double trolley system throughout, and so avoiding the necessity of using the rails as a return. Obviously a double trolley system means not only considerable increase in the use of copper, but, moreover, gives some little inconvenience in that each car is compelled to use two trolley poles instead of one. At the same time, where excessive speed is not required, care in handling the cars will minimise any little inconvenience arising from this cause. It is hardly necessary to say that double trolley systems are rare; at Cincinnati a double trolley system has been used in order to avoid as far as possible any interference with the telephone circuits. While on this subject it may be interesting to quote Mr. Philip Dawson, who in his work on "Electric Railways and Tramways," says of the Cincinnati lines that "the principal difficulties encountered were in preventing short circuits at the crossing of positive and negative wires. At turn-outs a second set of wires have been provided for one track, and the conductors on entering some of the curves have to transfer the trolley poles to a different set of wires. The cars pass the dead points in the branches by momentum, the current being carried past these points by insulating cables above the frogs. This system works satisfactorily, but it necessitates an enormous and most objectionable increase in the number of aerial wires. It also seems impossible to insulate the line properly. If one of the trolleys be taken off the line and connected to the rails, sufficient current would flow to light up all the lamps in the car, although not sufficient to move the car."

The many difficulties enumerated in the foregoing remarks are not likely to be experienced on the London United system, for though there will be practically throughout the system two tracks, which will necessitate four overhead wires, they will be connected up on the three-wire system. The two central wires will form the neutral, and the outside wires the positive and negative side. The neutral wire will be grounded at the station and at this point only. The three-wire system has been, of course, employed with considerable success in the United States, more particularly in Bangor, Me., St. Louis, and other places; and as far as one can learn, the balancing of these systems has been generally achieved without much trouble.

There is one distinct advantage gained by operating electric tramways on the three-wire system; that is, that as the motors are entirely independent of a good earth connection, the system can be employed in a better operating condition through the winter. Turning now to some of the electrical details which are adumbrated in Mr. Robinson's paper*, we find that the main generating station is at the present car depôt of the company in Chiswick. At this point considerable ground space is at the disposal of the company, and it is assumed that the present accommodation necessary for horses will give ample car storage and space for a large power house containing engines capable of developing 5,000 H.P. The building was designed to be a one-storey one, 154 feet long and 106 feet wide. It will be divided into an engine and boiler room, and the most modern arrangements are to be adopted both in the steam raising and electrical sections of the power house. Following the practice introduced of late years from America, the chimney shaft is to be built up of steel plates, lap-welded and riveted, tapering upwards, and finished with an ornamental cap. It is designed to be self-supporting, and is to be lined inside with fireproof

* Paper read before the Cleveland Institution of Engineers.

bricks. A similar type of smoke stack has been adopted at the new power house, which is being erected by the Dublin United Tramways Company. The first equipment of the boiler room will be eight horizontal water-tube boilers, which will develop steam at a pressure of 160 lbs., each boiler having a capacity of evaporating 8,250 lbs. of water per hour. Mechanical stokers will be adopted, the coal being fed into the stokers from bunkers located above the boilers. Between the coal store and the stokers will be placed weighing hoppers, which will record the amount of coal passed through to the furnaces, a similar system to that which we recently noted in use at the Bankside works of the City of London Electric Lighting Company.

In an important power house of this character it always pays to adopt elaborate arrangements for dealing with the fuel. It is proposed to carry coal from the ground level outside the building to the coal bunkers above the boilers by a gravity bucket type of conveyer, which is reported to have a capacity of handling 40 tons of fuel per hour. This conveyer will also be employed for removing ashes, dumping them into a special ashbin through which they can be rapidly removed. Another feature of interest in connection with the coal supply is a coal store of 2,000 tons capacity, which will be erected near the boiler room. The coal will be taken direct to these stores, from the North and South-Western coal depôt some 700 feet distant from the boiler room by means of a gravity bucket conveyer. Alongside the coal siding, and entirely below the surface, will be placed a receiving hopper with the necessary apparatus for the delivery of coal to the conveyer, thus enabling coal to be handled automatically direct from the railway trucks and to and from the company's coal stores and to the stoker hoppers.

The auxiliary plant possesses some interesting features. Two water towers are to be provided for cooling the condensing water, and these will be somewhat similar to those which we illustrated when describing the Barcelona tramways. They are of the twin type, arranged in two sections, having a capacity to deal with plant of 4,000 H.P.; the dimensions of the towers are 40 feet × 15 feet, and 38 feet high. The mats composing the cooling surface will be of galvanised iron wire netting. For each section of the tower there will be provided two air propellers, driven by electric motors.

Obviously the most notable features are in the power house, where the generating plant will consist of three-phase and continuous current generators. The latter will predominate, the three-phase machinery being utilised for supplying electricity to the extreme end of the system. The engines are to be of the vertical type, which, in itself, is somewhat of a departure from what we have been accustomed to in some of the later traction systems. They will be cross-compound condensing, and four of them will each develop 750 H.P. These will run at 90 revolutions, and will have cylinders 22 inches, 44 inches, and 42 stroke. Three of them will each drive two continuous current generators, while the fourth engine will run at 94 revolutions, and be direct coupled to a 500-kw. three-phase 5,000-volt generator, having a frequency of 25. The lighting necessary for the works will be provided by two 75-kw. 500-volt generators, each direct coupled to a two-crank tandem compound engine. A useful plant will be a motor generator set, consisting of one three-phase synchronous motor, having a capacity of 500 kw. at 5,000 volts; this will be direct connected to two 250-kw. 500-volt generators. The function of this plant will be to convert from direct to alternating or *vice versâ*, and will be of considerable use at times of light load, and will, moreover, serve as a spare generating unit. The switching arrangements will be, in many respects, similar to those in use on the Middlesbrough and Stockton lines*.

Near the extreme end of the system the three-phase current will be converted by means of four rotary converters. The sub-station is to be fed by duplicate three-core lead-covered paper cables, the current being transmitted at 5,000 volts. Air blast static transformers to the number of seven will be located here, and will transform down from 5,000 volts to 350. The rotary converters will each have a capacity of 200 kw., and are to be of the six-pole type running at 500 revolutions and delivering current into the line at 550 volts. These machines are also intended to act as balancers on the two sides of the system.

The rolling stock will be chiefly notable for the use of eight-wheel bogie cars, that type of car being the one so successfully used on the Middlesbrough lines.

* Electrical Review, August 12th, 1898.

THE REPORT OF THE PACIFIC CABLE COMMITTEE.

(*Continued from Vol. 44, page 1054.*)

Admiral Wharton, in speaking of the Fanning Island-Fiji section, pointed out that there were no soundings along two-thirds of this portion, and estimated an average depth of 2,700 fathoms varied by possible deep holes and rises in the bottom; which he characterised as very irregular. Since this evidence was given the route has been surveyed by the Hydrographical Department, and, with the exception of some inequalities in the vicinity of the Fiji Islands, the bottom has been found to be quite regular with an average depth of about 2,800 fathoms. Admiral Wharton also refers to the volcanic nature of this region, and points out that along the line from Fanning Island to the Phœnix Island group (one of which is the Canton Island of the route mentioned by Sir W. H. Preece) there are "a very large number of shallow banks, and also a depth as great as 3,400 fathoms."

The Hydrographer also points out that owing to the extreme steepness of the slope of the Phœnix Islands he doubted very much whether the cable could be laid there without a great deal of expense; this evidence bears strongly against the selection of Canton Island as a landing place. As regards the steepness of the slope of the islands along the selected route, the only one regarding which such a question arises is Fanning Island, and which has not yet been surveyed; but it should be borne in mind that experience of this class of landing place is by no means of rare occurrence in cable-laying. Bermuda, Turk's Island, Porto Rico, St. Jago de Cuba and St. Thomas, are all instances of very steep slopes in the Atlantic, some of them being coral fringed, and the cables landed on these islands have given no exceptional trouble. Mauritius is another instance. Excepting on the Fanning Island-Fiji section, Admiral Wharton's opinion of the selected route, although advanced with some caution, may be summarised as not at all unfavourable as far as the depth and the nature of the bottom is concerned. It is perhaps hardly worth while referring to the opinion expressed by Mr. Hesse, that all that portion of the route between Vancouver and Fanning Island is highly volcanic, as this opinion is neither supported by any known facts, nor does general knowledge of this zone in any way bear out such an assertion. We have gone into these points in some detail as they are all of importance in considering the route to be preferred. One of the advantages of a cable laid along the route chosen, is that the cable would land in the heart of the business district of Australia, thus avoiding the long land-lines which are a necessary adjunct to the present cable service and are a source of weakness. In going over the evidence relating to this portion of the subject, we have been much struck by the difference in the measurement of distance between similar landing places as given by the various witnesses, but on this, as on other points of the division of the report we are now considering, we are quite in agreement with the report as expressed by the Committee.

III.—What will be the Cost (*a*) of Laying, (*b*) of Maintaining the Cable, and (*c*) of the Annual Working Expenses?

(*a*) In regard to this subject we will limit ourselves simply to the only route which has met with acceptance, viz., that which runs from Vancouver to Fiji, touching at Fanning Island, and continuing on from Fiji to Norfolk Island, whence it bifurcates to New Zealand and to Australia. The tenders put in at Ottawa in reply to the invitation of the Canadian Government, which had been entrusted with this work by the members of the Colonial Conference held in Ottawa in June, 1894, were as follows:—

The India-Rubber, Gutta-Percha, and Telegraph Works Company	£1,517,000
W. T. Henley's Telegraph Works Company ...	1,826,000
Siemens Bros. & Co.	2,170,000
Fowler-Waring Cable Co.	2,350,000

These tenders are based on the general conditions prescribed; they include in each case the manufacture and laying of cables, which shall have for each section a calculated speed of not less than 12 words per minute, the providing of station buildings and instruments for the use of the staff, likewise the maintenance and repair of the entire length of the line for a period of three years after the whole line shall have been completed and put in operation. The condition being, that the cables are to be owned and controlled by Government, and to be worked under Government authority. Besides these tenders, a letter was received from the late Sir John Pender discouraging the project, and pointing out that a cable laid as intended would be quite useless, and would prove a commercial failure; but the writer wound up by stating that, if offered sufficient inducements, his company (the Eastern Extension Telegraph Company) could "undertake the work on better terms than could be offered by any other company." The chairman of the Telegraph Construction and Maintenance Company, after raising objections to each of the eight alternative routes for which tenders were asked by the Canadian Government, proposes a new route from Vancouver, taking in Honolulu and Samoa, and going to New Zealand only; trusting to the existing cables (the property of the Eastern Extension Company) for the communication between New Zealand and Australia. This cable he offered to lay for £1,870,000, which, however, does not include maintenance for three years, nor, indeed, for any period. The route here proposed would make the Pacific cable to a great extent a feeder for the system of the Eastern Extension Telegraph Company, who charge 3s. per message of 10 words, with 5d. for each additional word between New Zealand and Australia. Sir W. H. Preece gave the estimated cost of the cable which he had "sketched out" to meet the specification as £2,924,000; adding to this £159,900, the estimated cost of a cable from New Zealand to Australia, omitted in the above, and, also to make it comparable with the tenders, adding £180,000, the minimum amount estimated by Sir W. H. Preece to cover maintenance for three years, we have a total of £3,264,000. The extraordinary total of this estimate is mainly due, to those responsible for it, having in the case of the Vancouver Island-Fanning Island section taken too great an overground distance; to this excessive distance 20 per cent. of slack has been added, and on the erroneous length so obtained it has, for some obscure reason, seemed fitting to those who "sketched out" this estimate, to adopt a core weighing 940 lbs. of copper and 940 lbs. of gutta-percha per knot—a distribution of material inexcusable on either practical or economical grounds. In explaining away this estimate before the Committee, Sir W. H. Preece pointed out that for the sheathing, steel wire costing £45 per ton had been adopted in this estimate (dated 1893), whereas steel of strength and quality amply sufficient for the purpose could be got for £12 per ton (in 1896), which item alone meant a reduction of £400,000 or £500,000 on this Post Office estimate!

In relation to the core, a diminution to 750 lbs. of copper and 600 lbs. of gutta-percha is suggested, and so the "revised" Post Office estimate of cost is arrived at, as being not much over £2,000,000. Even this revision is a very different story from that given in Mr. J. C. Lamb's letter of July 5th, 1893, which, as coming from the technical advisers of Her Majesty's Government, was circulated among the Colonial Governments by the Colonial Office, and thus three months after it was written, it turned up at the Antipodes in time to act as a damper on the mission of the delegates sent by the Canadian Government to Australia, to try to come to an arrangement with the Australasian Governments concerning the Pacific cable, among other things.

The representatives of the Eastern Extension Telegraph Company estimated the cost of laying a cable along the selected route at "something like £1,650,000" for the making and laying of the cable, erecting the stations, and supplying apparatus, but exclusive of maintenance. Mr. J. C. Lamb estimated the capital cost at £2,000,000, to which he applied £154,860 annually for interest at 3 per cent., maintenance and working, and sinking fund. Even this figure is just £72,304 less of an annual charge than that which Mr. Lamb gave in July, 1893. We may look on this also as a "revised" Post Office estimate. The same witness calls attention to the fluctuation in the price of material. In speaking of the estimate put in by his firm, Mr. Alexander Siemens pointed out that (just as was the case with the Post Office authorities) he had estimated for wire at £50 per ton, of which, as he showed, it would have taken about 20 years for the makers to supply the necessary 11,000 tons turned out at the usual rate, but by adopting the usual deep-sea wire, giving 96 tons breaking strain per square inch, a reduction of some £500,000 could be made in his tender. As, however, Mr. Siemens says that when he sent in his tender, he did not look on it as a firm offer, but "only to give the Governments an idea what the thing might cost," it is not surprising that he did not go into the figures so closely as Her Majesty's technical advisers, not being influenced by commercial strategy, might reasonably have been expected to do. The India-Rubber, Gutta-Percha Telegraph Company also submitted tenders for cables along the selected route, capable of giving a speed greater than 12 words. These figures were, for a 15-word per minute cable, £1,672,000, and for an 18-word per minute cable £1,880,000. We must bear in mind that the figures given in the actual tenders were submitted to the Canadian Government in October, 1894, and that the price of material, as pointed out in Mr. Chamberlain's letter of April 28th last, has since that date altered considerably, not enough, however, in the natural condition of the markets to entail any very large increase.

THE VOLTA CENTENARY.

EXHIBITION AT COMO.

[FROM OUR SPECIAL COMMISSIONER.]

THE exhibition now in progress at Como claims to be international for electrical appliances and machinery and national for the silk industry. In view of the importance of such an event as the Volta Centenary, and the well-known characteristic of the Italians to wax enthusiastic over their great men, we were expectant of some striking exhibits. But several visits to the galleries failed to impress us with any sense of importance or novelty. Whatever was lacking in energy and enthusiasm in the exhibition was amply compensated for by the wonderful demonstrations which centred round the International Congress of Telegraphists held in the same town as the exhibition. Readers of the ELECTRICAL REVIEW cannot afford to remain ignorant of these events.

First, however, as to the exhibition. The site chosen for the buildings is picturesque in the extreme. Nestled down in the south-east corner of the beautiful lake, and facing the steep face of Brunate, the exhibition is well situated for easy communication by rail, water, or road. The erection is not very large, but is very pretty. The front consists of a crescent-shaped gallery with façade, measuring about 130 metres from end to end. The extremities are surmounted by two towers constructed in imitation of the well-known Voltaic Pile. From the back or eastern side of this gallery open out three extensive galleries, the centre one terminating in a large circular building which is devoted mainly to the entertainment section of the exhibition. Running parallel with the face of the building and intersecting the central circular gallery are the two galleries devoted to the electrical exhibits. From another point in the central hall opens a small gallery devoted to motors. The *Salle d'entrée* was occupied by telegraphic apparatus employed in the telegraphic competition which continued for a week during the festivities, the extensive Salle being roped off for the purpose.

Brioschi Finzi & Co., of Milan, have a very extensive exhibit of electrical machinery for driving printing machines. Notable among their exhibits is a large lithograph press constructed by the Leipziger Schnellpressenfabrik Vorm Schmiers Werner and Stein, Leipzig. With a comparatively small motor the huge machine was being effectively driven, and was turning out first class work. Norberto Arbizzoni, of

Monza, exhibits a small handy motor which can be readily applied to treadle machines without removing the treadles. The same firm exhibits a large flat press driven by a motor of the same form constructed by Ditta G. Gadda & Co., of Milan. Several forms of bicycle motor are exhibited. The best we saw was a rather cumbersome, heavy machine, for which it was claimed that it could be applied to any type of bicycle or tricycle without alteration of the wheels. This was constructed by Carlano, Milan, and exhibited by the agents, Oreste Rossi, Via Dante 14, Milano. An electric motor tricycle of an exceptionally cumbersome description is exhibited by Prenetto & Stucchi, but the absence of any attendant precluded us from discovering what virtues were claimed for it. An exhibit, for which a very important claim was made, next came under our notice. This was no less than a "Perfected Edison Phonograph," which was called "Bettini's Micro-Phonograph." The inventor, who hails from Milan, was very reticent concerning his apparatus, which appeared to give the same results as a well-adjusted phonograph. Werth, of Milan, has an extensive plating exhibit, about which we saw nothing new either in method or construction. The Naples Electric Light Company have a very large show of switches. One of the largest exhibits is that of Ellicott Bros. Improved forms of electrical machines occupy the first part of the stand, and the direct reading potentiometer has chief place. They have also a large display of coast signalling apparatus.

A very large show of ingenious electrical domestic appliances is made by the Italian Commerce Company. We were surprised to find that in nearly every instance an inspection proved these appliances to be of American manufacture. There is room for English competition in this field, which appears to be a growing one. This practically completes the electrical exhibition, which, it will be seen, is of little or no importance.

At the southern end of the electrical galleries is a good sized room devoted to the exhibition of relics of Volta and Galvani, and the collection appears to be a tolerably complete one. In the wall cases are exhibited Volta's diplomas and patents of nobility, those from the Great Napoleon being undoubtedly of the greatest interest. In a large case, prominently placed, is a collection of the apparatus used by him in his physical researches. Chief among these is the original pile, which it is claimed is actually the original as constructed by Volta. A condenser, an electrophorus, a eudiometer, a crown of cups, and a number of objects used by Volta in his researches into the nature of gases complete a most interesting collection. In each case the objects are stated to be actually the originals, as used by the great discoverer. A very realistic model of the skull of Volta surmounts the case.

In the same hall there are also some very interesting relics in the shape of physical apparatus employed by Galvani, and a large number of diplomas and original editions of his works. This section of the exhibition seems deservedly to be the most popular and attractive.

(To be continued.)

CONDENSERS FOR ELECTRIC LIGHT AND POWER STATIONS.

This paper, read by Mr. J. F. C. Snell before the Municipal Electrical Association at Bristol, we shall publish in full. To the ordinary steam engineer accustomed to regard the consumption of coal from a serious point of view, the practice of electrical engineers is simply astonishing. Mr. Snell calls it wholesale reduction of efficiency—and very correctly. Unsound financially, it is equally unsound engineering. Thus an engine with a pressure of 135 lbs. absolute has a back pressure of, perhaps, 6 lbs. (21 lbs. abs.). If condensing, its back pressure is only 3 lbs. abs. The ratio is 114 : 132 as regards pressure, but the temperature ranges are 350 to 231, and 350 to 127, and one engine would thus have an efficiency of 1 87 times that of the other on the basis of

$$\frac{T - T_1}{T - T_2}.$$

In any case there are the further advantages of abolishing the greasy rain from the exhaust pipe, there is less boiler cleaning. The type of condenser is affected by locality, and, broadly, condensers are divided into surface and jet variety. Mr. Snell is properly in favour of surface condensers, because of the freedom from impurities in the water produced, and the freedom from scale which is secured, though there is always the lubricating oil to be considered—it must be got rid of. At Sunderland, the author has decided to employ artificial water cooling and self-contained surface condensers to each of a pair of 500-H.P. dynamo sets, with a cooling tower and fan draught. With water of 25° hardness this seems wise. The condensing plant is estimated to cost 45s. per E.H.P.

He recommends separate condensers for large engines, even if the pumps are separately driven—that is, he would not have a condensing plant common to two or more large engines. It is an advantage, he considers, to have the condenser near to the L.P. cylinder, and below it also, to secure good drainage from the cylinder. For small sets the condenser may be common to several engines with advantage, though, of course, this introduces the risk of every set being suddenly and simultaneously deprived of vacuum, whereby the whole service may be impaired. But we need not follow the author further as we intend reprinting the whole paper. We desire, however, to emphasise his arguments. There is rarely occasion to employ non-condensing engines on permanent work. The argument of short water supply should now be exploded, for, by special cooling, less water is necessary by several per cent. when condensing than when non-condensing. Yet many electrical engineers have put down considerable powers with neither condensers, nor flue feed-heaters, nor have they even provided means to heat feed water by means of exhaust steam, but have simply blown away the steam to the atmosphere, and bought water to replace it. The author's remarks on evaporative condensers may be read with profit. Given tube enough, a condenser may be run without any cooling water. The air is sufficient.

We hear a good deal about high speed engines consuming but little oil. The author refers to graphite lubrication. Engine makers do not seem to take to any system of lubrication which is not exceedingly wasteful of oil. The old idea of an occasional drop or two of oil seems to have given way to very wasteful usage. Engines are made to use very little steam, but the oil consumption is becoming important. In place of steam tests a few oil consumption tests might, with advantage, be published. We are convinced that much lubricant is being wasted in some of the engines now made for electrical purposes.

PARLIAMENTARY COMMITTEES.

Great Northern and Strand Railway Bill.

This Bill came before a House of Lords Committee last Friday. Mr. Balfour Browne, Q.C., who appeared for the promoters, explained that the Bill had already been before a House of Commons Committee, and had been agreed to. The only opposition now came from the London County Council in respect of Section 4 of the railway, which would run from Holborn to the Strand under the new street which the London County Council were proposing to make. The line, as proposed, would run from Wood Green to the Strand, and would be 6 miles 2 furlongs and 7 chains from end to end. It would be constructed in two tunnels, and would cost £2,287,903. It would, from Wood Green to King's Cross, run under the Great Northern Railway, and from King's Cross to Holborn under private property, while, as he had stated, from Holborn to the Strand, the line would be under the County Council's new street. The line was not being promoted by the Great Northern Railway, but as a separate undertaking. The tunnels would be small tunnels, and would not be capable of taking the rolling stock of the Great Northern Railway, nor could they be used for any traffic except passenger. The only petitioner against the Bill was the London County Council, and he thought it would be found that theirs was really not a hostile opposition. In fact, he believed that the London County Council must see, as everybody saw, what an enormous improvement it would be to London. In their petition they referred to the promoters wishing to have the use of the soil without payment. The petitioners were purchasing the whole of the property involved in the new street, and they would have no use for the layer underground.

Counsel proceeded to deal with the London County Council's petition against the proposal. Sir Henry Oakley was called, and gave evidence of the grave difficulty the Great Northern Company had in dealing with its enormously developed

suburban traffic, and after mature consideration it was felt that a line worked by electricity as proposed was the best means of dealing with the traffic. The number of suburban passengers on the Great Northern Railway was increasing at the rate of one million a year. The cost of equipment would be between £300,000 and £500,000. They would make the railway as light and as airy as possible to attract passengers to use it. Their Holborn platform would be alongside the platform of the Central London Railway, so that a man could come from Wood Green and get to Shepherd's Bush or Cricklewood without coming to the surface. It was expected that it would take four years to construct. Cross-examined by Mr. Freeman, Q.C. (for the London County Council) Witness said there was certainly no case for the company paying anything to the London County Council. The engineer of the Council and the engineer of the company could easily agree as to the exact line for the railway. He knew that as a matter of fact in the three electrical schemes which had been before Parliament that session cheap train clauses had been inserted, but, in his opinion, they were bad for the railway and for the workmen. He knew that the new clause suggested was that workmen should be allowed to travel by any train up to 8 o'clock at a certain fare, and to return by any train, but at a penny fare it was impossible to make it pay.

Further evidence was called, but Mr. Freeman said all his desire was that the scheme should not spoil the great scheme of the London County Council.

The Right Hon. G. J. Shaw Lefevre, the chairman of the Improvements Committee of the London County Council, was called by Mr. Freeman.

Mr. Fitzgerald (for the promoters) said there was no scheme whatever in the air of any other company coming and asking to go under the street, and even if there was, it would be easy to lay their tunnels on one side of the street. What, however, underlaid all the opposition of the London County Council was that they wanted a contribution from the company towards the cost of the new street.

The Committee decided to consider the London Improvement Bill of the London County Council dealing with the Holborn to Strand new street before giving a decision, and, after hearing part of the case for that Bill, the Committee decided that the Bill should proceed, and refused to insert clauses suggested by the London County Council as to any payment for wayleaves or for further provision for workmen's trains, holding that the matter was sufficiently dealt with by the general law.

Baker Street and Waterloo Railway.

Before the Committee on Thursday last week this Bill was considered. Mr. E. Page and Mr. J. Shaw appeared for the promoters, and Mr. Lewis Coward was for the Brompton and Piccadilly Railway Company, who were the only petitioners. Mr. Shaw said the Bill was to extend the period for the construction of the authorised line for three years from 1901, when the authorised time expired, and to make the station under Trafalgar Square in place of Cockspur Street, and make public subways at Charing Cross. As the Committee knew the Bill had already been before a Committee of the House of Commons which had, however, struck out those portions which related to branch lines to Paddington and Euston stations by which it had been intended to give facilities to passengers using the Great Western and the London and North-Western Railways. The clause for the proposed generating station at Paddington had also been struck out. The only opponents to the Bill now were the Brompton and Piccadilly Railway, who asked that the promoters should be bound to make their railway at a certain depth where they proposed to cross the proposed line of that company. He contended, however, that the petitioners had no *locus standi*, inasmuch as they were not owners or occupiers, and had not yet got their Bill. Mr. Coward said the petitioners had been negotiating for property, and he only asked for a protective clause. After consideration, the Committee decided that the Brompton and Piccadilly Railway Company had no *locus standi*. The Committee then went through the clauses of the Bill as amended by the Commons, and ordered that it should be reported for third reading.

Newcastle Tramways and Electricity.

The Select Committee of the House of Commons met on Wednesday last week, under the chairmanship of Sir Stafford Northcote, to consider a Bill promoted by the Corporation of Newcastle-on-Tyne, by which they sought additional powers for general purposes, including the running of the tramways in the borough by electricity. Mr. Pember, Q.C., and Mr. Moon represented the promoters of the Bill; Mr. Pembroke Stephens, Q.C., and Mr. T. Dickinson appeared for the Newcastle-on-Tyne Electric Supply Company, Limited, and Mr. Edwin Short represented the Newcastle and District Electric Lighting Companies in opposition to the Bill. Mr. Moon, in opening the case for the promoters, said that the main object of the Bill was to construct and re-construct a large number of tramways in Newcastle, and to work them by electrical energy. By Section 7 of the Bill the Corporation proposed to construct or re-construct 20 miles of tramways, and to work them by electricity, and Clause 26 provided that they might use certain lands for the purpose of constructing a station for the generation of electrical energy. Those clauses were not opposed by the two companies appearing in opposition—the real opposition arose upon Clause 99, which would enable the Corporation to employ the electric energy for the purpose of lighting the public streets and public buildings, the quay, market, or other property of the Corporation for the time being of the Corporation in the borough. The use of the electric power for the cranes on the quay was a most important matter, but the two electric supply companies opposed the granting of such power on the ground that it would lead to unfair competition with them. In the present case the competition would not be at all a serious matter, but even if it were he (Mr. Moon) maintained that such competition was perfectly legitimate, and had been recognised by Parliament to be so. As regarded the street lighting, at present the two companies who were opposing only lighted 24 lamps between them, and with regard to supplying electricity as motive power, the companies could not supply it economically because they both worked on the alternating system. Therefore, the Corporation were not competing with those companies, because the objects to which they sought to apply and utilise electricity were not objects which the electric companies were now carrying out, or could successfully carry out. In conclusion, the learned counsel pointed out that, by the Act of 1888, Parliament had recognised the right of local authorities to enter into competition where a Committee of the House were of opinion that such competition was justifiable.

Mr. Hill Motum, the town clerk of Newcastle, having given evidence in favour of the Bill, Mr. C. Hopkinson, C.E., said that the same electric plant that supplied the power to the tramways could be used for other purposes. In his opinion, it was a matter of importance that the general supply should be under one control.

Mr. Dickinson (for the Newcastle Electric Supply Company) called Mr. J. T. Merts, a director of the company, who stated that he had held that position since the formation of the company in 1889. The company was incorporated with a capital of £50,000, which had since been increased to £100,000. At the start they adopted the alternating system, but they would shortly be in a position to supply direct current. They had 850 consumers, and supplied many of the public buildings. They could supply electricity for public purposes quite as cheaply as the Corporation.—Mr. J. S. Watson, assistant engineer to the Electric Supply Company, said that Clauses 15 and 23 of the Corporation's Bill could be prejudicial to the company unless an undertaking were given by the Corporation that they would make compensation for any disturbance of the company's wires, and that the Corporation should give a proviso that outside authorities should not supply inside Newcastle.

The Chairman pointed out that the Corporation only asked for power to supply their own buildings, and there was no question of setting up a hostile company.

Mr. Pembroke Stephens, Q.C., addressed the Committee for the company, and contended that as the company could not have obtained its provisional order without the consent of the Corporation, the company were there with the consent of the local authority; but now the local authority asked Parliament to give them powers in derogation to their grant. There was really no use making bargains between companies and corporations and getting the sanction of the Local Government Board if all was to be reduced to a sham.

The Committee decided to pass the Bill.

Charing Cross and Strand Electricity Supply Corporation's Bill.

On Monday a Select Committee of the House of Commons, under the chairmanship of Col. Gunter, sat to consider the Provisional Order Confirmation Bill of the Charing Cross and Strand Electricity Supply Corporation, Limited, giving them power to supply electricity within the area of the City of London. Mr. Pember, Q.C., and Mr. Shiress Will and the Hon. Sydney Holland appeared for the promoters. The petitioners were the City of London Electric Lighting Company, represented by Mr. Pope, Q.C., Mr. Balfour Browne, Q.C., Mr. Freeman, Q.C., and Mr. Rokeli, and the City of London Corporation, represented by Mr. Littler, Q.C., Lord Robert Cecil, Q.C., and Mr. A. D. Walter.

Mr. Pember, Q.C., in opening the case for the promoters, said this was the City of London Electric Lighting Order for the lighting of the City of London, given to the Charing Cross and Strand Electricity Supply Corporation. The order had been granted by the Board of Trade, and he thought the principle of competition in electric lighting was now thoroughly established. There was hardly a part of London where competition had not been sanctioned. The City of London Company had always used the alternating current principle, but the Charing Cross Company had always used the direct current in their existing districts, and they intended to use it in the City if the order was confirmed. In all probability there would have been competition in the City of London itself long ago had it not been that in the early days of electric lighting the Corporation made certain agreements with the existing company, which, however, were quite invalid and could not bind Parliament. The Corporation had been advised that the agreements were invalid, but he understood the question would be eventually tried in the Courts of Law. However, he had nothing to do with those agreements, because they could not override the law. For some time dissatisfaction had existed in the City with regard to the electric lighting, and the matter had often been considered in the Common Council. At last the Charing Cross Company, one of the most successful and one of the best conducted companies in London, came forward and applied for an order, feeling that there was ample scope for them in such a rich area as the City of London. Their example was followed by the Metropolitan Electric Lighting Company and the Smithfield Electric Lighting Company, and all three applications were heard before Sir Courtenay Boyle, and his company produced a petition in their favour with 5,000 signatures, while the Smithfield Company produced a petition with 10,000 signatures. Having thoroughly inquired into the matter, Sir Courtenay Boyle decided to grant a competitive order, and he selected the Charing Cross Company to have the order. In doing this he dispensed with the consent of the City Corporation, who considered their hands tied by the agreements referred to. He should call evidence to show that the present supply was inefficient and expen-

sive, but in view of the great amount of evidence which was called before Sir Courtenay Boyle on this point, he would not trouble the Committee more than he could help. There had been certain personal matters in the matter which he would not go into.

Mr. Pope, Q.C., said he had better go into them because there was no charge against the City of London Company.

Lord Robert Cecil said there was no charge against the gentlemen concerned. It was simply said that he was a member of the Corporation and also a shareholder of the company which promoted the City of London Company.

Mr. Pember said he made no charge against anyone. He only referred to the matter because it was brought into the Board of Trade inquiry. His position was that whatever agreements there were they were perfectly null and void. The Charing Cross Company was registered in 1889, and its capital powers were 250,000 ordinary shares, of which 150,000 had been issued, and 100,000 preference shares, of which the whole had been issued. Their shares were now being issued at 100 per cent. premium. They proposed to increase the capital of the company by £800,000 for the City undertaking, and to supply consumers in the City for lighting at 5d. a unit, to be reduced, according to consumption, to 4d. per unit, and for motive power at 3d., with a sliding scale to 2d. These charges were below those at present of the City of London Company. Sir C. Boyle recommended that the order be granted to the company, on the condition that the City Corporation should have the opportunity of purchasing at a reasonable date from the time of the order, to be agreed upon hereafter, and that time had now been agreed upon. In 1914 the Corporation would have the option of buying up the existing company if they chose to exercise it, and in the same year, and any time thereafter, they might, if they liked, buy up the City undertaking of the Charing Cross and Strand Company.

Mr. Edward Wilmot Seale, secretary of the Charing Cross and Strand Company, said the company first supplied in the St. Martin's District in competition with the Metropolitan Company and the London Electric Lighting Company, and afterwards they got competing powers with the Metropolitan Company in the Strand and St. Giles and Holborn. The order for the last two districts was granted last year, and they had already laid 18 miles of mains in those districts. In the Strand and St. Martin's districts they had hung what was equivalent to more than 157,000 8-candle-power lamps, the company last year standing fifth on the list of metropolitan companies in regard to supply. They supplied the new Admiralty buildings, Somerset House, the Constitutional Club, the National Liberal Club, the County Council offices, the Lyceum Theatre, Drury Lane Theatre, Covent Garden Theatre, the Hotel Metropole, the Hotel Cecil, the Grand Hotel, and many other large buildings. He attributed the success of the company to the lowness of their charges and to the freedom of failures. His company's average price was the lowest charged by any private metropolitan company, and was lower than the price charged by three of the four metropolitan local authorities who supplied themselves. The City of London Company were charging about 42 per cent. more than they did. His company would supply light in the City at from 5d. to 4d. per Board of Trade unit, and motive power at from 3d. to 2d. per unit. He thought that if their district was extended some of the large newspapers would take motive power.

Evidence was then given by Mr. Edwards, of the Canadian Pacific Company, Mr. G. E. Mead, of the Sun Fire Office, and others, as to the present insufficient supply of the City of London Company.

The Committee then adjourned.

At the resumed sitting of the Select Committee on Tuesday, Mr. Seale was recalled for cross-examination, and said that the company's charge for motive power was 3½d. if 15 hours' power per week was taken, and if over 15 hours' power was taken the charge was 2¾d. per unit. They had 15 or 20 customers who took motive power.

By Mr. Roskell: The Board of Trade dispensed with the consent of the Strand local authority. There had been no complaints as to their taking up the streets in the Holborn district. There had been complaints in the St. Giles's district, where they had to leave open a trench quite unavoidably. He did not say that complaint was unfair, but the St. Giles Board of Works had treated them severely.

The Chairman: In parts of London I notice that the electrical mains appear to run under the footways. Is it necessary to take up the streets?—Sometimes not. It depends entirely on the question of the mains.

In Grosvenor Place and about there they are putting down mains under the pavement, and do not interfere with the street at all. Is it necessary to take up the streets?—It is only necessary to lay them in the streets where there is no room under the pavements. The County Council and the local authorities are making it a standing order, wherever possible, to lay the mains under the pavement where it can be done.

Mr. Roskell: And in St. Giles you lay mains both under the pavements and the streets?—Yes, the same as all other electric lighting companies.

Further examined by Mr. Roskell, Witness said he was not aware that the City of London Company were under statutory obligations to lay aside a considerable sum to depreciation account, or that £119,000 was so invested by that company in Consols. The Charing Cross Company invested their reserve fund more profitably in their own business. He would say that the actual reserve of their company was £30,000, and that £100,000 would stand to share premium account. The share capital to which the premium would apply was being subscribed at the present time. He should say that the restaurants and luncheon bars in the City would use as much light as those of the West End. He did not say under present conditions that was so. At present he admitted that the demand in the City was shorter in duration per day than in the Strand. He suggested that there was a wide field for the employment of electric energy wholly untouched in the City at the present time. The charge they proposed for public lighting was the same that the City of London Company charged at present.

By Mr. Shiress Will: Whatever might be the demand in the City for electric lighting, his company were perfectly prepared to take the risk, and two other companies were also willing to take the risk.

Mr. W. H. Patchell, the engineer of the Charing Cross and Strand Electricity Supply Corporation, said he had held that position for six years. Having explained the difference between direct and alternating current, witness said that for arc lighting the alternating current was not satisfactory. For motive purposes the direct system was the most satisfactory. For the last six years the whole of the laying of mains had been done under his direction, and in districts where there were competing companies. He had found no difficulty in laying mains that could not be got over. Competing companies did not use the same trenches. The case mentioned by Mr. Seale was the only case in which they had had any trouble with the local authorities. They had fogs just the same as they had in the City, and their load was liable to jump up on such days. They provided against that by having spare plant and also battery power. They were increasing their batteries at the present time. Batteries could not be used with an alternating current. There was no way of storing alternating current to make it commercially successful. With a reduced price they looked for an increased consumption of energy in the City, because that had been the experience of all companies. In 1893 the average price obtained by their company per unit was 5·29d., and the units sold were 28·07, while in 1896 the price was 4·70d., and the units sold 32·4. The dividends of his company were 4½ per cent. in 1893 and 1894; 5 per cent. in 1895; 6 per cent. in 1896; 7 per cent. in 1897; and 8 per cent. in 1898. If they supplied light at 5d. per unit in the City, they anticipated a larger demand than two hours per day for five days in the week. With regard to the Board of Trade schedule price in respect to the order, a private person in the City would pay for one hour per day 5d.; for 1½ hours 4·66d. and for two hours 4·5d. That was the average price. The reduction took place after one hour's daily use of the maximum. The maximum would be the amount of lamps which he asked for and which he could use.

Mr. Balfour Browne, Q.C.: And he might have 50 lamps to burn occasionally and never get any reduction at all.

Continuing, Witness said the price of the City of London Company was 7d. per unit for the first six units per quarter per 8-candle-power lamp; 6d. for the next four units per quarter; 5d. for the next two units; and 4d. all over that. A customer would have to consume electricity for two hours before he got a reduction, and it was this state of affairs which, in his opinion, retarded the use of electricity in the City, as the charges ran so high. Under their schedule, if authorised, a consumer would have to consume electricity for motor purposes for 2½ hours of his maximum demand, and would get the reduction from 3d. to 2d. At present, his company had on their mains 1,136 consumers.

Witness having been cross-examined by Lord Robert Cecil as to the company agreeing to insert certain clauses with respect to the charge for motive power, it was intimated that the promoters case was closed, and a discussion then ensued as to whether the Corporation or the City of London should be heard next.

Mr. Pope, Q.C., charged the Corporation with having sat on the fence all along, and said the City of London Company were entitled to know on which side of the fence they meant to come down before he went into his case.

Lord Robert Cecil said the Corporation had no commercial interest in the matter, and their attitude might depend on whether the company could or could not answer the allegations of the promoters.

The Chairman said the Committee would prefer to hear the company first, and

Mr. J. C. Bull, manager and secretary of the City of London Electric Lighting Company, was called, and said the prospectus of the company was issued on July 14th, 1891, 40,000 ordinary shares being offered for subscription, but only applications for 2,410 were received from the public. The directors and their friends, with the issuing houses took 30,152 shares, and the remaining 9,848 shares were offered for subscription in January, 1892, but only 6,258 were taken up, and the remainder were placed by the Electric and General Company. The capital of the company now consisted of 40,000 £10 preference shares, 60,000 £10 ordinary shares, and £400,000 of 5 per cent. debentures, or £1,400,000 in all. The expenditure upon capital account had been nearly £1,600,000 up to the present date, and the net revenue in 1898 was £97,842. The public lighting for the year ended 1892 resulted in a loss of £706, while the profit for the year ended 1898 was £662 12s. 8d. No dividends were paid from 1891 to 1893, but in 1894 2½ per cent. was paid; in 1895, 5 per cent.; in 1896, 7 per cent.; in 1897, 10 per cent.; and in 1898, 6 per cent. The number of private customers had increased from 242 at the end of 1892 to 7,414 at the end of 1898, while on June 21st last the total was 7,876, and this notwithstanding the alleged high prices. In 1895 the average price obtained per unit was 7·56d., and in 1893, 6·22d. Several customers had discontinued generating their own energy, and had taken their light from the company. It was not correct to say that the arrangements being made for a continuous current were only made in consequence of the threatened opposition of the Charing Cross Company. As far back as 1895, Mr. Bailey, the engineer, was instructed to give attention to the introduction of that system of supply, and he had been working at it ever since. The company now possessed plant for the supply of continuous current to the extent of 200 kilowatts, and by November next would be able to supply 3,000 kilowatts.

The Committee adjourned.

The Telephone Bill.

The Standing Committee on Trade met on Monday last to consider the Telephone Bill of the Government.

The first clause, viz, a grant of £200,000 for the purpose of the Telegraph Acts, was agreed to without discussion. On Clause 2, which empowers the payment of expenses under a telephone license, Mr. Hanbury, who is in charge of the Bill, moved to leave out the word "county" in the phrase "where the council of a county borough are licensed by the Postmaster-General." He said that as the purpose of the Bill was to enable licenses to be granted to urban districts the word "county" was not necessary.

Mr. Tomlinson said he understood the original idea to be that the authorities to which licenses should be granted were large bodies. He understood further that they were to have, with respect to telephones beyond their borders, similar powers to those which they possessed with regard to gas and water. Was that so?

Mr. Hanbury replied in the affirmative. If the Postmaster-General considered that the proper working of a telephone system in a borough or an urbn district required its extension outside—that was, between the suburban dwellings of business men and their urban works or offices—the urban authority would receive permission to make the extension if they could obtain the consent of the outside authority, but the Postmaster-General's license in such a case would not give them compulsory wayleaves in a jurisdiction not their own.

The amendment was adopted.

Col. Long proposed that the Postmaster-General should only issue telephone licenses by means of a provisional order confirmed by Parliament.

Mr. Hanbury remarked that the real object of his hon. friend was to kill the Bill. At any rate, the amendment would weaken the hands of the Post Office. So far as ground licenses in municipalities were concerned, there was no need for the clause. The necessity for it arose from the fact that even if a telephone license were granted by the Postmaster-General, the local authorities had not at present power to borrow or spend money for the purpose of putting it in operation. Should the amendment be passed, the Local Government Board would be enabled to intervene quite unnecessarily, and the Parliamentary proceedings might cause useless delay, expense, and annoyance.

Sir J. Joicey supported the amendment, and said it was very natural that Mr. Hanbury should be angry with anyone who would interfere with the Post Office, but it was equally natural that some people should look with distrust on a project permitting local authorities to spend any amount of money on telephones. Those persons who might object to the exercise of such a power ought, at least, to have the right of appealing to Parliament.

Mr. Cawley, in speaking against the amendment, said that municipalities had the right to control gas, water, and electricity, and he did not see why they should be hampered in respect to telephones.

Mr. Cohen supported the amendment because, he said, he wanted to check the growth of municipal enterprise outside proper municipal limits.

Sir J. Woodhouse said that to give all kinds of people power to come to Parliament and oppose the granting of telephone licenses would defeat the object of the Bill. Were the minority in a borough or urban district council to be allowed, after they had been defeated on a proposal that a telephone license should be applied for, to put the ratepayers to great expense in order to carry their opposition further? He thought not. The Postmaster-General ought to be left to decide whether he would issue a license or not.

The amendment was negatived by 30 votes to 9.

Mr. C. McArthur said that he would move the omission of the clause as a protest against the principle of municipalisation. There were many objections to the proposal. In the first place, it involved the multiplication of systems within the same area, and the question arose how these different systems were to be brought together. There must either be some arrangement between the various authorities for laying junction wires, or the Post Office trunk wires must be extended so as to connect the various systems; and that would involve great expense. There was also the objection that, according to the decision just taken, any one of these authorities might, with the consent of the Postmaster-General, impose a telephone system on the ratepayers without first obtaining the consent of Parliament. Then their licenses were to be extended for 25 years.

Mr. Hanbury pointed out that that was entirely in the discretion of the Postmaster-General.

Mr. McArthur said that it was, at any rate, permissible, and therefore, in fairness, the same facilities ought to be given to the National Telephone Company, whose license expired in 1911.

A division was then taken, and the clause, as amended, was approved by 35 votes to 7.

Mr. Hanbury then proposed the following new clause, which embodies the concessions made by the Government to the National Telephone Company and other opponents of the Bill:—"1. Where an existing company have, before the passing of this Act, under a license from the Postmaster-General, provided a system of telephonic communication in any area, and it is proposed to grant a new license to a local authority or to another company to provide telephonic communication in the same area, then if the existing company consent to it being made a condition of their license (*a*) that they will not give favour or preference to any person whomsoever within the area in question, and will not, as a condition of giving a service, require from any person the grant of any facility, except for the purpose of supplying telephonic communication to that person, and (*b*) that their charges shall not, within the area in question, exceed or fall below those authorised in that behalf by the Postmaster-General within that area, it shall be a condition precedent to the grant of a new license that where it is proved to the satisfaction of the Postmaster-General that the existing company have incurred, or contracted to incur, material expenditure in laying down underground wires, and have acquired a wayleave from a local authority for that purpose, the wayleave shall, within the area in question, continue for the period for which the new license is granted, but on the same terms and conditions, except only as to such continuation as those upon which the wayleave was granted, unless varied by agreement with the local authority. (2) An existing company shall not, without the consent of the Postmaster-General given after the passing of this Act, in each case open an exchange in any area included in their license in which they had not, before the passing of this Act, established an effective exchange. (3) Where a local authority or new company under a license from the Postmaster-General provides a system of telephonic communication in any area in competition with an existing company licensed by the Postmaster-General before the passing of this Act; then, if the existing company consent to it being made a condition of their license (*a*) that they will not give favour or preference to any person whomsoever within the area in question, and will not, as a condition of giving a service, require from any person the grant of any facility except for the purpose of supplying telephonic communication to that person, and (*b*) that their charges shall not within the area in question exceed (and where the local authority grants underground wayleaves, shall not fall below) those authorised in that behalf by the Postmaster-General within that area the license of the existing company shall within the area in question be extended and continue for the period for which the license of the local authority or new company is granted, but except as varied by this Act, the provisions of the license of the existing company shall remain in force."

Mr. Stuart regarded the proposed clause as a departure from the conclusions of the Select Committee. That body was convinced that the license of the National Telephone Company should not be extended beyond 1911. This clause provided for the granting of licenses to new companies, and the prolongation of the National Company's license as long as the new licenses should last. The authorization of new telephone companies was an even wider departure from the conclusions of the Committee than the one he had just named. The Post Office had not been a very effective competitor with the National Telephone Company. It had gone down like a house of cards before that body, and there was no guarantee that it would be firmer with new companies. Besides, how did anybody know that in a short time the National Telephone Company would not buy out all new competitors, and so become greater and stronger that ever?

Sir C. Cameron said he thought the clause was an immense improvement on the Bill, because it would ensure telephonic competition.

Mr. Cohen supported the clause.

Sir J. Woodhouse said the clause was a very complicated one, and had only been published two or three days ago, and he had received numerous communications from municipalities asking for time to study it and frame recommendations upon it. He hoped that the Committee would not be asked to decide upon it before Thursday, and therefore he moved the adjournment of the debate.

Mr. Hanbury said he did not ask that the clause should be added to the Bill at this sitting, but only that it should be read a second time. If that were done, he would undertake to communicate before Thursday with Sir J. Woodhouse, and if possible with the municipalities, to see whether they could not come to some arrangement which would be fair to both the National Telephone Company and the municipalities. He thought it possible to conclude some arrangement which would satisfy the latter.

Mr. Seton Karr complained that under the new clause the Postmaster-General would be absolutely autocratic as to the prices for telephonic communication. If so, where did competition come in? That was a point for consideration.

The motion for the adjournment having been withdrawn,

Mr. Hanbury explained the effect of the clause at some length. With regard to the prohibition of preferences, he said the National Telephone Company had, in the past, drawn customers from the Post Office by preferential rates. The prohibition of such proceedings would be a great advantage to municipalities who established telephone exchanges. There was another point. Hitherto the National Company had been able to say to a tradesman: "Although your rival has telephonic communication, you shall not have it unless you allow us to put a pole and wires on the top of your house, with leave to us to enter your premises and look after the pole and wires." The Government wanted to prevent that kind of thing. They would not allow either municipalities or new companies, or the present company, to give preferences of any kind. With regard to prices, they meant to fix a maximum and a minimum for all competitors in the same area. The minimum in the case of a municipal enterprise would prevent the rates being unduly drawn upon, and would, in all cases, probably save the Post Office from taking the telephones at unremunerative rates, if nationalisation came, as it might do, in 25 years, the period for which new licenses would be granted. It was to the interest of the municipalities that a minimum should be insisted upon, because a municipality competing with the National Telephone Company would have only one area, while the company would have many. The minimum rate would be subject to periodical revision, accounts would be submitted annually to the Postmaster-General, who would vary the rates if necessary. As to the new companies, there would be a great difference between them and those which had hitherto existed. The latter had general licenses, and the National Telephone Company in buying them up had only one operation to perform in each case. The Government would issue no more general licenses, and would guard against the danger of telephone companies being purchasable at all. The Treasury minute with regard to municipalities carried out this view, and another Treasury minute would apply it to new companies. Again, new companies would differ from their predecessors in being under Government control, as he wished the National Telephone Company was. In addition, they would

be practically under the control of municipalities, for the Post Office would not grant a license if there was no efficie service, and there could not be an efficient service without underground wayleaves, the granting or the withholding of which was in municipal hands. Coming to the question of the extension of the National Telephone Company's licenses, he admitted that a Committee of the House of Commons recommended in 1892 that the licenses of existing telephone companies should not extend beyond 1911. The general license of the National Company would cease to exist after that year. That was not all. Its other licenses would end at the same time wherever there was no competition. If the municipalities were averse to the presence of the National Company in their area, and yet wanted to establish telephone systems, they would simply have to ask for licenses which would expire in 1911. They would be able to obtain renewals, but the National Company would not. The company's licenses would terminate for good and all either in 1911 or in the year when the first competing licenses expired. The Government wanted not only the authorities of large towns where the National Telephone Company was already established to create telephone systems of their own, but they also wanted the smaller authorities to do the same. That was why they laid it down that the National Company should not work where they had not already got an exchange. But for this provision the company might prevent the small authorities from laying down telephones by threatening competition. The only other question with which he had to deal was that of intercommunication between rival systems. He was as anxious as anybody that there should be intercommunication between the telephone exchanges in one area, but he feared he should not be able to get the National Company to agree, especially as he had obtained very fair concessions from them already. It would not be fair to insist on free intercommunication where the local authority, for instance, had a small exchange and the company a large one, but it would be reasonable if fair payment were made for terminals. The Government had promised that when the National Company worked in communication with new competitors, such as the Glasgow Corporation or the new Manchester Company, the former's new plant (constructed under the eye of the Postmaster-General) should be purchased by the State on the termination of the license.

Sir J. Joicey said he objected to the clause, because he desired the nationalisation of the telephone.

The second reading was agreed to by 28 votes to 5.

The Committee adjourned till Thursday.

The *Times* says that, thanks to the excellent progress made on Monday, there is every probability that the Standing Committee on Trade will finish their examination of the Telephone Bill at the next sitting.

LEGAL.

Hyde Corporation *v.* Oldham, Ashton, and Hyde Electric Tramways Company.

The case of the Mayor and Corporation of Hyde *v.* the Oldham, Ashton-under-Lyme, and Hyde Electric Tramways Company was heard on July 3rd before Mr. Justice Grantham, sitting without a jury in the Queen's Bench Division of the High Court. Mr. Macmorran, Q.C., and Mr. Sutton appeared for the plaintiffs, and Mr. Cripps, Q.C., and Mr. Bartley Dennis for the defendants.

Mr. Macmorran said this was an application for an injunction to prevent the defendants breaking up the footpaths in Hyde for the purpose of laying electric cables for the electric traction of a tramway in that town. The facts were admitted, and he now contended that the Corporation were within their rights under the provisional order in interfering. This order provided that the carriages used on this tramway might, with the permission of the Board of Trade, be moved by electric traction. The Tramway Act of 1870 was incorporated with that order, and that Act provided that the term "road" should mean any carriageway being a public highway and the carriageway of any bridge forming part of or leading to the same. The power to break up the roads was given by Section 56:—"The promoters may, from time to time, for the purpose of making and laying down, and for the maintenance and renewing of any tramway, open and break any road, subject to the following regulations." Then followed the regulations. Having the power to break up the road was given to any "road," and the term "road" was defined to be the carriageway of the road. He submitted that whatever power the company might have to break open any road in the borough was limited to the carriageways, and that under the section there was now power to break up the footpaths. In July, 1898, the company gave notice that they intended to break up the footpaths in order to lay electric cables to feed the overhead wires with power to work the trams. Negotiations followed, and eventually the Corporation decided that the work should be allowed to go on if the company would contribute a further £500 towards the expenses of certain road improvements, in addition to £500 which had already been promised.

Mr. Cripps, Q.C., said the Corporation seemed to have been ready to give their consent if the company paid a second sum of £500, and the company having paid one sum of £500 thought that was sufficient. His first point was that the company had got the power under the order to break up the footways, and his second was that, even if they had not that power, under the Battersea case, which had just been decided by the House of Lords, no injunction could be granted, because the company were not trespassers, being underneath the footway, and the rights of the Corporation only extended to the surface. He also contended that there was no damage done by the company. All the Corporation could do was to bring an action against the company for damages; but as no damage was done, that would be fruitless. Some time ago the Board of Trade, after consultation with a committee of experts, laid down certain regulations with regard to the method to be adopted with regard to these tramways. An interview was held with Major Cardew, of the Board of Trade. He made certain requirements, which were complied with, and the system was now in operation.

Mr. Justice Grantham: To come here now seems rather like locking the door after the steed is stolen.

Mr. Cripps said so far as the injunction was concerned, it was quite an impossible suggestion.

Mr. Macmorran: We protested all through.

Mr. Cripps: No; only to a certain point.

Mr. Justice Grantham said if it was wanted to stop what was done, application could have been made in Chambers. He supposed what they were really discussing was the £500.

Mr. Cripps said it was too late for that now. He contended there was no limitation of the word "carriageway" in the Act, and that it did not exclude footpaths.

Mr. Macmorran, for the Corporation, said it was not at first intended to lay cables under the paths. Even assuming that the company had power to lay the cables, he was prepared to show that they could be properly laid under the roads. He also contended that great damage had been done to the footpaths, and that it had cost some £100 to properly flag the streets which had been taken up by the company.

Mr. Joseph Mitchell, the borough surveyor of Hyde, said the company's original plan did not show any wires under the paths. The company had done damage to the extent of £100 to the footpaths, and had also taken up the space that the Corporation required to put wires for their own electric supply to the town.

Cross-examined: When he went round with the Board of Trade inspector in May last, he did not say a word of his objection to having the wires under the footpath. He denied that the whole object of the Corporation in raising the question of underground mains was to obtain money for the town's improvements.

Mr. Charles Hopkinson, a consulting engineer and electrical expert, said the cables could have been laid in the carriageways quite as well as under the footways, and it would not affect the system at all.

Mr. W. Hedderstedt, who was in charge of the work when the cables were laid below the pathway, said after it was carried out the paving was infinitely better than it was before. The chance was very remote that it would require repaving again for 10 or 12 years. It was not true that some of the flagging was not yet replaced.

Mr. E. Malen, who was in charge of the electrical work for the contractors, said he replaced by sound stones all stones broken in removing the pavement. The part that was relaid was better than before. It was not true that there had been any subsidence in the flagging.

Mr. Justice Grantham said the case raised a very important point. The question was whether an electrical company could, under the old tramway powers of the Act of 1870, arrange with the Board of Trade to break up the footpath as well as the carriageway for the purpose of their electrical plant. In his judgment they could not. It was clear that when the Act of 1870 was passed no one dreamt of electric tramways, and it was equally clear that no such wide powers as those claimed were intended by the Act. He did not think the case came under the Battersea case which had been quoted, and he thought under the circumstances he must give judgment for the plaintiffs for an injunction and for £100 damages. Execution would be stayed for six months to enable the parties to come to an understanding.

Blackwell *v.* Greenwood & Batley, Limited.

Mr. Justice Bruce gave judgment in the Queen's Bench Division on Monday (July 3rd) in the case of Blackwell *v.* Greenwood and Batley, Limited, which was recently tried at length before his Lordship. It was an action brought by Mr. Robert Winthrop Blackwell against Messrs. Greenwood & Batley, engineers, carrying on business at Leeds, to recover £605 for electric standards and other appliances supplied to the defendants in connection with the construction of electric tramways at Leeds. The defendants counterclaimed for £525 damages paid to three passengers who were injured by the breaking of one of the standards.

Mr. A. Cohen, Q.C., and Mr. Manisty appeared for the plaintiff, and Mr. Robson, Q.C., and Mr. Muir Mackenzie for the defendants.

In 1896 the defendants entered into a contract with the Corporation of Leeds to construct a new electric tramway in that town, and they obtained their electrical standards and other appliances from the plaintiff. In August, 1897, one of the standards broke, and an accident occurred, injuring three passengers, who brought actions against the Corporation and recovered damages. The Corporation subsequently obtained repayment of the damages and costs, amounting in all to £525 from Messrs. Greenwood & Batley, who in the present action counterclaimed to recover that amount from the plaintiff on the ground that the standard which caused the accident was defective. The plaintiff denied that there was any defect. His lordship said the evidence given on behalf of the plaintiff had failed to satisfy him that the designs for the working of the tramway was a bad or faulty design. The trolley standard which was broken on August 16th was not to be found, and they had not been told as to the circumstances under which it was broken. There was no evidence as to its being defective, and, in fact, the evidence tended to prove that it was of good quality and without flaw, and that there was no defect in the casting. It was probable that the standard

was broken by reason of some unfair strain or violence. The defendants bound themselves to be answerable for all accidents unless they could satisfy the engineers or the Corporation that the accidents arose from other than defective workmanship or material, but the plaintiff did not bind himself to serve the Corporation on any such terms. The onus of proof was against the defendants to establish their case against the plaintiff, and that they had, in his opinion, failed to do. There would be judgment for plaintiff, with costs on the claim and on the counterclaim.

CORRESPONDENCE.

Remarks on Extracts from a Contemporary re Competitive Telephony and Non-Competitive Winchester House Telegraphy.

To the casual reader, the following extracts from one of your contemporaries for June 30th, 1899, seem to be scarcely compatible. Thus, in its first note, on the Winchester House visit to the Chancellor of the Exchequer and to the Secretary of State for the Colonies, we find—

The Marquis of Tweeddale . . . . *was able to show convincingly that* the objects sought by some of the colonies, viz., *a reduction of rates* and an alternative Pacific or other cable, *could be much more efficiently and economically attained by private enterprise.*

Again—

And we wonder that the Press do not see that a *State-owned Pacific cable would lead to a veritable monopoly, which it is not at all in their interests to bring about.* In some cases competition is good; in others, lower rates and better service can often be best secured without competition.

On turning over a few pages, we come to an article on "Competitive Telephony." I again quote two passages—

Those who have studied the problem presented by the state of telephony in this country have realised that the system will only be *at its best when it is controlled and also managed by a State department.* . . . .

We have frequently expressed our views in favour of a *telephone monopoly, worked either by the Post Office or an allied Government department.*

The italics are my own. How consistent! How disinterested!! There is plainly some function governing the ratio of alterations advisable in the control of the telephone systems differing vastly from that applicable to telegraph systems. Assuming that function to be in the shape of prospective benefits or the reverse to the country at large, the problem can be expressed thus:—

"From the ratio of proposed indefinitely large changes in two somewhat similar monopolies of magnitude, to ascertain the functions which will govern the changes."

I accept the fact, that the functions are diametrically opposite—that the problem is mixed and ridiculous; but put in this light it gives a fairly clear representation of Winchester House argument as applying firstly to themselves, secondly to their competitors.

H. B. F.

Cologne, *July 1st*, 1899.

Wholesale v. Retail.

Your correspondent, "A Disgusted Retailer," opens up a question which, as a purely commercial one, is, I consider, of vital importance to the electrical trade. Whilst sympathising with him on a subject which frequently hits me, and no doubt many others similarly situated, very hard, I cannot help feeling that the wholesale trade is placed by circumstances in a very difficult position. It is, however, in the interests of the latter to protect those of the retailer, but as "Manufacturer and Designer" points out how are they to distinguish where "the Trade" commences and where it ends? It is notorious of our countrymen that we are good at grumbling but slow in adopting measures to remove the cause of our complaints. Now, why not something practical?

Without taking up your space with detailed suggestions, I would submit that it is possible for the wholesale trade, by concerted action, to institute a system whereby all those who are justly entitled to trade discounts should be registered by some specially constituted body, whose duty it should be to inquire into the *bonâ fides* of those whose line of business it is to supply the public with any particular class of electrical goods. If then, the wholesale trade, by common consent, were to refuse to allow discount except to such registered retailers, it would obviate the cause of our very reasonable complaints.

It will no doubt be objected at first that the suggestion of concerted action is too empirical to meet with success, but let it once be realised that the present evil militates as much against the wholesale as the retail trade, and I venture to think that something could be done for our mutual protection.

Let me put just one illustration of what is constantly coming under my notice. A is a chemist, for example, who sells the necessary materials for charging electric batteries, and, as admitted by "Manufacturer and Designer," is entitled to trade discount on electrical requisites. One day he comes to the conclusion that he will have electric light in his shop instead of gas, or perhaps he requires a telephone installation. He immediately proceeds to obtain the necessary fittings and materials of the wholesale dealers B or C, who allow him the same discount as any of their legitimate customers who stock electrical goods. Then all he has to do is to find a fitter at so much an hour to do the rest. I submit, sir, that he has no more right to that discount than his next door neighbour the butcher, but if B will not allow it C will. This is how the wholesale traders are gradually killing the geese that lay the golden eggs.

One of the Geese.

Replying to "Manufacturer and Designer," the firm of dynamo manufacturers were advised in this particular case that their machine had been recommended and quoted for, and I therefore claim, and am grateful for the sympathy of "Manufacturer and Designer." At the same time it should not be necessary to advise wholesale houses or manufacturers of probable business; the advisability of so doing being to my mind very doubtful.

I quite agree that the question is a difficult one to deal with, and would like to ask "Manufacturer and Designer" the following questions:—Does he get, say, his plumbing, gas fitting, decorating done at trade prices; or furniture, medical supplies, &c., with trade discount? I anticipate not! I fail to see why wholesale houses, to whom the business must eventually come, should, in their anxiety to secure orders, thus allow the efforts of those who have large establishment expenses to be undermined to those whose interests are not strictly electrical.

A Disgusted Retailer.

Controllers for Traction Work.

Can you, or any of your readers inform me through the medium of the REVIEW, wherein lies the patent, if such is the case, regarding the controllers now commonly used for street railway work? Is it in the general construction or in the magnetic blow-out attachment?

J. C.

BUSINESS NOTICES, &c.

Accumulators in Belgium.—A company has just been formed in Brussels with a capital of £20,000, to be known as La Société de l'Accumulateur Tobiansky.

Artesian Wells for Electricity Works.—Following the lead of many large establishments in London the directors of the London Electric Supply Corporation have determined to procure water at their Deptford works from the practically inexhaustible supply in the chalk, for boiler feeding purposes, and it is shown that a very large saving in expense will be effected by thus dispensing with the water company's service. The well, which is being commenced by Merryweather & Sons, will be lined with cast-iron cylinders to exclude surface water, and an artesian boring will be carried into the chalk from the bottom of the sinking. It is somewhat surprising that the number of private wells in London is not greater than it is—particularly in those districts served by water companies whose supplies are liable to curtailment in the dry season.

Bankruptcy Proceedings.—The case of John E. Liardet, engineer, Old Mill Works, Cowley, and 16, Hyde Park Gate, W., came before Mr. Registrar Brougham, last Friday, at the London

Bankruptcy Court. The Official Receiver reported that the debtor had lodged an application for the Court's approval to a scheme of arrangement providing for the payment of a composition of 7s. 6d. in the pound to the creditors. The liabilities amounted to £13,254, and the sum required for the composition and expenses, about £5,000, had not yet been paid into Court. Mr. Ringwood, on the debtor's behalf, applied for an adjournment. Some delay had occurred in obtaining the money, but it would be in hand very shortly. It was proposed to form a syndicate to take over one of the inventions of the debtor and it had to be examined by an expert, but there would be no difficulty in lodging the money before the next adjournment. His Honour ordered the application to stand over for a month. The debtor has been experimenting in marine, electrical, and hydraulic patents at the Old Mill Works, and he attributes the failure to his inability to realise the patents to advantage.

The first meeting will be held on July 10th, and the public examination on August 3rd, both at Bankruptcy Buildings, W.C., in the case of J. G. M. Hilton, electrician, Bow Common Lane, London.

July 11th and 13th are the dates for holding similar proceedings at Victoria Street, Liverpool, in the case of B. Wild & J. H. Clarke (Wild, Rothwell and Co., general and electrical engineers, Virginia Street, Southport).

In the Edinburgh Bankruptcy Court last week, Stothert McLaren, electrical engineer, appeared for examination. Examined by Mr. George Cowan, S.S.C., the trustee, the bankrupt said he began business in August, 1897, as an electrical engineer. Previous to that he had been in the employment of the Corporation Electric Lighting Department. He also took on an ironmongery stock in addition to his electrical goods. At that time he had practically no capital, but borrowed £275. He had paid back nothing of that money. He first found himself in difficulties about two months ago, while a contract with the Corporation was going on. He attributed his deficiency of £805 to losses on contracts with the Corporation: on the Tollcross power station, £165, and on the City Chambers, £30. To his dealings with ironmongery, £45; to domestic trouble, £35; and to depreciation in the value of his stock, £100. He only kept 30s. a week for himself in order that the business might pay. The value of his contracts while in business would be over £3,000. The state of affairs showed the assets to be £553 and the liabilities £1,358.

At the Bradford Bankruptcy Court on 4th inst., a receiving order was made against the estate of Arthur Blackburn and Arthur Walker, carrying on business at Upper Lane Mills, Cleckheaton, as electricians and mechanical engineers, under the style of Blackburn, Walker & Co.

Liquidations, Dissolutions, &c.—Messrs. W. A. Gent and J. S. Richardson (Gent & Richardson, patentees and electrical engineers, Suffolk Street, Birmingham), have dissolved partnership.

Creditors of the Electrical Time Recording Company, Limited, are required to send particulars of their debts and the usual information to the liquidator, Mr. A. B. Clifton, 31, Bedford Row, W.C., by August 18th.

Creditors of the Fowler-Waring Cables Company must send particulars as to debts, &c., to Mr. J. A. Blackwood, liquidator, 110, Fenchurch Street, E.C., by August 4th.

Blackman Ventilators.—At the Royal Show, Maidstone, last week, the Blackman Ventilating Company, Limited, exhibited a Blackman air warmer and fan, an electric Blackman fan and motor combined, a Blackman fan driven by steam, and a hop kiln in operation (Blackman system).

Clean Boilers—The advantages of a really good preparation for neutralising the scale-forming salts found in most feed waters cannot be overrated, and there are few engineers who would not readily adopt such a remedy if they could be persuaded of its efficacy. From what we learn of "Dejecoline," it certainly appears to be prepared on thoroughly well-known scientific principles; and the manufacturers, who have the great advantage of being analytical chemists, and, therefore, should know their business, make a careful examination of each feed water submitted to them for treatment. On ascertaining the quantity and quality of scale-forming salts existing in the water, they modify their "Dejecoline" boiler fluid to neutralise same. This method, on the face of it, is in accordance with common sense and practical experience, and this specially prepared "Dejecoline" has been found a great success at a number of electric lighting stations in this country. Its increasing popularity is claimed as a proof of its efficacy for the purpose for which it is intended, viz., the removal and prevention of incrustation in boilers and steam pipes.

Coast Defence.—It is stated in the *South Wales Daily News* that the Government is erecting an electrical station and search light at Lower Penarth, for the defence of the Bristol Channel. It will be used by the Severn Submarine Miners. The station is being erected on the highest point of the cliff, which is about half a mile on the Penarth side of Lavernock Point.

An Electric Launch.—No doubt the reason why electric launches have not increased in numbers more than they have has been due to the fact that up to quite recently the various types of batteries available gave only a relatively small output compared with their heavy weight and did not last very long in addition. The following particulars of the recently built electric launch *Magic*, belonging to the Dee River Boating Company, Chester, will no doubt be interesting. It is built to carry 25 people, is 28 feet long, 6 feet broad, and 2½ feet deep, and has a displacement of 3 tons. With a full complement of passengers it has a maximum speed of 8 miles an hour. The battery consists of 26 Headland storage cells made by the Headland Electric Storage Battery Company, London. It has a capacity of 350 ampere-hours and weighs complete only 15 cwt. The normal current discharge rate is 30 amperes at half speed, and 50 amperes at full speed. The greatest distance travelled so far with one charge is about 50 miles at 8 miles an hour, while the battery has already run the launch upwards of 500 miles. The electro-motor is a 3½ H.P. L type "Taunton," taking 50 amperes at 50 volts and 600 revolutions per minute, corresponding to 8 miles an hour. There are two speeds, "half" and "full," and by means of a reversing switch which interchanges the terminals of the field magnet coils, the launch is able to proceed at either of these two speeds ahead or astern as the case requires. In order to obtain the above two speeds the battery is sub-divided, and for starting or half speed the controlling switch puts the battery in two parallels direct on to the motor, while for full speed all the cells are in series and direct on to motor, no resistances being used. The battery is placed in the centre of the launch under the raised floor. The *Magic* is noted for being the fastest electrically-driven launch on the picturesque Dee and has undergone severe trials as regards speed and capacity of the battery, both of which we learn are considered highly satisfactory.

The Institution of Junior Engineers.—The special London district excursion of this Institution took place on Saturday, July 1st, the destination being Hatfield. At Hatfield House a deputation of the party was received by Lord Hugh Cecil, M.P. On the estate are some interesting examples of the application of electric energy for pumping, farm purposes, &c. Visits are to be paid in July to Messrs. Simpson's engine works at Pimlico, and to the Shepherd's Bush electric generating station of the Central London Railway. The summer meeting, occupying a week, commences on August 11th, when Portsmouth and Southampton are to be visited, the president this year being Sir William H. White, K.C.B., F.R.S., Director of Naval Construction and Assistant-Controller of the Navy.

Labour Prosecution.—Messrs. Ashton & Frost, of Blackburn, have just prosecuted 40 men who absented themselves from work at their foundry because of intense heat, the works being stopped for two days in consequence of the action. The magistrates gave a verdict for the employers in the majority of the cases, with nominal damages amounting to 2s.

The Lizard Lights.—In the House of Commons on Tuesday in reply to Mr. Field, Mr. Ritchie said he was informed that for navigation reasons the Lizard lights have been so constructed as to be practically obscured from the adjoining coast, but in any case he did not think that the inquiries suggested by the hon. member as to electric light could lead to any useful result. He believed it to be true that in certain circumstances oil light did to some extent penetrate further than electric light.

Municipal Trading.—In the House of Commons on Monday Mr. B. L. Cohen, L.C.C., asked the First Lord of the Treasury whether, seeing that it had been found impossible this session to appoint the Joint Committee on Municipal Trading, he could give an assurance that the Government would appoint the Joint Committee in question early next session. In reply, Mr. Balfour said he hoped the committee would be appointed as desired.

Nalder & Hilton, Limited (in liquidation).—As will be seen from an advertisement in this issue the debenture holders of the above company are offering the business for sale as a going concern.

Provisional Orders.—The Camborne Electricity Supply Company's Provisional Order Bill, and the Clontarf Council's Bill, were last week certified for second reading; also the East Retford and Swinton Orders.

The Bermondsey Order Bill was read a third time, and passed in the House of Lords, last week. The Grimsby Street Tramways Bill was sent for third reading in the Commons.

The Electric Lighting Provisional Order (No. 5) Bill, which relates to Alloa, Montrose, Kilmarnock, and Inverness, was read a third time and passed.

The Shipley Council's Provisional Order has passed through the House of Lords, and has reached the first stage in the House of Commons.

The Kensington and Notting Hill Electric Lighting Bill has been read a third time and passed in the House of Lords.

The Liverpool Overhead Railway Bill with regard to the running of electric trams throughout the Waterloo district has passed the committee stage and was awaiting the third reading, and will probably receive the Royal assent in the middle of July.

The Kirkcaldy Electric Lighting Bill is to come before the House of Commons as an unopposed measure. A deputation has been in London in connection with the scheme.

Testing.—We have received a neatly arranged and well illustrated booklet showing Atkinsons' Testing Works, Cardiff. The owners of the works are Messrs. L. B. and Claude W. Atkinson, who have opened laboratories for mechanical, electrical, and chemical testing. Pictures are given of the offices and various laboratories and workshops.

Trade Announcements.—Mr. John Meek has been appointed district superintendent at the Edison & Swan United Electric Light Company's West End branch, 53, Parliament Street, S.W., and will represent the company in the S.W. district.

Mr. John Legg, Nelson Street, Swansea, has, it is announced,

taken his two sons, Messrs. C. and W. Stanley Legg into partnership. Mr. Stanley Legg will undertake electric lighting and general engineering work.

Messrs. A. & W. Hopkins notify that they have taken Mr. Sydney S. Galsworthy into partnership, and that the business having been amalgamated with that of the London Electrical Fittings Company, and registered as a private company, will in future be carried on under the name of "The London Electrical Fittings Company, Limited" under the same management as at present.

Messrs. Barnett & Jones have opened premises at 30, Kingsland Road, N.E., as electrical engineers.

Messrs. Hurst, Nelson & Co., Limited, builders of tramway and light railway rolling stock, &c., intimate that their London office is now at 14, Leadenhall Street, E.C.

ELECTRIC LIGHTING NOTES.

Ashton-under-Lyne.—A trial was made of the public arc lamps on June 29th. The contract has been in hand nearly two years, but was delayed by the strike.

Barnard Castle.—A Newcastle Syndicate proposes to apply for a provisional order for supplying this district. The company will be called the Northern Counties Electricity Supply Company. The utilisation of water-power and some disused woollen mills, is suggested.

Barnsley.—In consequence of the number of applications received for electric light, an additional 250 I.H.P. electric light plant is to be provided at an estimated cost of £2,000; and tenders are to be obtained for enlarging the buildings.

Bermondsey.—The Electric Lighting Committee reported to the Vestry, at the meeting on Monday, that the London Electric Supply Corporation had withdrawn their petition in the House of Lords against the Bill to confirm the Vestry's provisional order, and that the Bill had been read a third time and passed by the Lords. The committee stated that they had referred to a sub-committee the question of inquiring for a site for the erection of a generating station and refuse destructor.

Birmingham.—An electric light installation has been fitted in the Central Free Libraries, with marked advantage to both the readers and the books.

Blackburn.—The General Purposes Committee of the Blackburn Corporation on June 26th advanced the salary of Mr. Giles, the electrical engineer and tramways manager, by £100, to be further increased by a similar amount next year.

Bournemouth.—The electric light installation of the pier and pleasure gardens was formally inaugurated on June 28th. The installation comprises 24 arc lamps and about 100 incandescents. It is probable that the public lighting of the town will shortly come under consideration; the Corporation obtained a license in 1893.

Brazil.—The contract for the electric lighting of the city of Juiz de Fora, Brazil, has been given to Messrs. James Mitchell and Co., of Rio de Janeiro, agents for the General Electric Company of America. The contract includes 50 street arcs and 100 16-C.P. incandescent lights, and also plant for a private lighting capacity of 4,000 16-C.P. lamps. The power will be derived from the Caraudahy Falls, 10 kilometres from the city. It is expected that the service will be inaugurated on January 1st, 1900. We believe that Messrs. Johnson & Phillips and the Brush Company were the only British firms to quote for this work.

Brechin.—Some time ago a company was formed in Brechin and Montrose (under the registered title of the Angus Electric Light and Power Company, Limited) to introduce electric lighting into these towns, and to carry on the business of electrical engineers, electricians, &c. The company has now secured premises in Brechin, and will probably start operations without delay.

Bridgend.—The draft transfer of the Electric Lighting Order to the English Industrials, Limited, has been submitted to the Bridgend District Council. It was considered in committee, but it is understood that it was decided to lay it before counsel for an opinion on it.

Buxton.—The District Council has decided, on the recommendation of the Electric Lighting Committee, to establish an electric wiring department. Two members protested against the injury to private tradesmen that would result.

Chelmsford.—The Electric Lighting Company has declined the offer of the Corporation to purchase the undertaking for £24,000, and has withdrawn the offer to sell. The price asked by the company in the first instance was £42,000.

Cheltenham.—At the last Council meeting the mayor mentioned that, as illustrating the progress of electricity, the number of electric light customers was now 313, taking 20,000 8-C.P. lamps, against 250 customers taking 16,000 lamps last year.

Chorley.—At a meeting of the Chorley Town Council on June 29th, it was decided that a site in Bengal Street, which is the property of the Corporation, was in every way suitable for the proposed refuse destructor house and electric lighting station.

Dartmouth.—The Corporation has referred to committee two proposals relative to the electric lighting of the borough.

Dorking.—The Urban District Council, having entered into a five years' agreement with the gas company, has decided to postpone the installation of electric lighting for that period, and has declined to sell the provisional order to an electrical company.

Drumcondra.—At a meeting of the Urban District Council last week a letter was read stating the terms on which the Dublin District Electricity Corporation, Limited, was prepared to supply electrical energy, viz., 4d. per unit for public and 5d. per unit for private lighting. It was resolved that the Local Government Board be asked that the Council be empowered to enter into such arrangements as they may deem most advantageous with the Dublin District Electricity Corporation, Limited, or others, as they may be advised.

Dublin.—The Carmelite Church, Clarendon Street, has been fitted with a very complete electric light installation, including a 17-H.P. gas engine and dynamo, and a battery of accumulators. The fittings are of a highly ornamental character, and 90 lamps are used, varying from 16 to 200-C.P., making 3,440 C.P. in all. The work was designed and carried out by Messrs. Cummins & Sons, of Dublin.

Edinburgh.—The Electric Lighting Committee, on June 27th, recommended the acceptance of estimates for the extension of the boiler house at Dewar Place station, amounting to a little over £2,000, and estimates for the formation of a siding at M'Donald Road station, amounting to somewhat over £1,000.

Electric Lighting (Clauses) Bill.—On Tuesday this Bill passed through Committee and was reported to the House.

Electric Lighting of St. Paul's Cathedral.—In connection with the offer of a wealthy American (Mr. Pierpoint Morgan) to light the interior of St. Paul's Cathedral with electricity, the *City Press* says that experiments in lighting the vast building have been made. These have proved most satisfactory, and arrangements are in progress to equip the cathedral with the most complete installation of electricity.

Epsom.—Last week the District Council considered in committee the report of Mr. Hawtayne on the electric lighting tenders.

Felling.—The District Council has received notice from the Electric Power Distribution Company intimating that they intend to seek powers to supply electricity in the district.

Gorton.—Mr. Thomas Wright, a London electrical engineer, has been engaged by the Urban District Council to report upon the advisability, or otherwise, of the Council exercising its powers with respect to the supply of electricity to the district.

Heathfield.—A small company has been formed for supplying the district with electricity. It has a capital of £5,000 in £5 shares, and a prospectus has been issued locally.

Henley.—The question of the electric lighting of the borough was brought up at a recent meeting of the Town Council, and it was resolved to make inquiries into the matter.

Kendal.—The results of the recent plebiscite show 183 answers in favour of electric lighting, and applications for 1,584 lamps. It is probable that the matter will now be pushed forward.

Kirkwall.—At a recent meeting of the Town Council, notice was given of the following motion:—That it be remitted to a committee to inquire and report whether it be advisable for the Corporation to introduce into the burgh lighting by electricity.

Lancaster.—Compared with the year 1897-8, there was an increased output last year at the Corporation electricity works; the total being 209,947, against 150,519 units. The expenditure amounted to £1,682, against £1,355, or 1·92d. per unit, against 2·11d. The income was £4,007 4s. 3d., against £2,901 18s. 7d.

Leeds.—Some time ago a sub-committee was appointed by the Electric Lighting Committee of the Leeds Corporation to negotiate the purchase of the Britannia Mills Estate, Whitehall Road, and take into consideration the general question of electrical development in the city. They have decided to instruct Messrs. Hopkinson and Talbot, consulting electrical engineers to the Corporation, to report upon the whole subject, but with special reference to the extension of electric lighting and power to the suburbs—a work rendered difficult on account of the scattered character of the districts

concerned, and the fact that the present installation, put down by the House-to-House Electricity Company, is not commercially available for power to any great extent. Messrs. Hopkinson & Talbot are to be paid a fee of 200 guineas for their work.

Leek.—The Electric Lighting Committee of the Urban District Council considered returns which had been received from various towns where electric lighting had been adopted, and recommended that Messrs. Morton, Goodwin and Ingham, with the clerk and surveyor, visit two of the following places for the purpose of obtaining further information:—Nelson, Shoreditch, Stafford, or Llandudno. After discussion, the recommendation was agreed to.

Llandudno.—Mr. A. H. Preece's report on proposed extensions came before the Council last Monday. He said that the time had arrived when it was necessary not only to consider the new plant required for the light railway, but also further plant for meeting the large demand for electricity for lighting. The capacity of the works as designed was to meet a demand from 7,000 lamps. There were already nearly 8,000 lamps. He recommended the Council to order at once one boiler, one engine and dynamo. The cost of this would be £3,000, but the additional plant would enable them to supply 12,000 lamps of 8 candle-power. The acceptance of the terms by the Light Railway Company for supplying them with electricity rendered it necessary to be in a position to supply them. The railway was to be ready next season, and the supply of electricity must be ready at the same time. The cost of the plant needed for the railway would be £8,250. The details of the total additions would involve an expenditure of £11,250. The Council has resolved that application be made to the Local Government Board for sanction to borrow for the provision of plant for supplying current to the Light Railway Company, £8,250; and for extension of plant for lighting purposes, £3,000.

London, E.C.—At the Court of Common Council on Thursday last week, Mr Algar, chairman of the Streets Committee, brought up a report relative to proceedings commenced by the City of London Electric Lighting Company against the Corporation in the Chancery Division of the High Court for a declaration that the electric lighting agreements are valid and existing. The committee asked power to defend the action unless the company were prepared to make such terms as regarded efficiency and cost as would confer greater benefits on the consumers and ratepayers, and thereby enable any invalidity of such contracts to be removed, if necessary, by a fresh agreement. Mr. C. T. Harris hoped, for the honour of the Corporation, that the report would not be adopted. The Corporation had hitherto declined to take the step of obtaining the declaration that the contracts were null and void. Mr. Wallace thought the time had come when the whole subject should be dealt with by a special committee. After a long discussion, the report was carried.

The London County Council has decided to approve the plans submitted by Mr. F. Bailey on behalf of the City of London Electric Lighting Company for the construction of an additional boiler house at the company's generating station, 64, Bankside, Southwark.

Malton.—At a meeting of the Urban District Council a letter from the secretary of the Northern Counties Electric Supply Company, announcing their intention of forming a syndicate for the supply of the electric light in the district, was read, and the clerk was directed to acknowledge receipt of same.

Manchester.—The Electricity Committee of the Corporation presented its annual report to the Council on July 5th. For the year ended March 31st there was an increase of 44 per cent. in the output, amounting to 5,633,534 units. The number of consumers on March 31st, 1899, was 2,570, there being an increase of 515 during the year. The total length of mains now laid is 130,457 yards, or 74 miles 217 yards of mains, an increase of 28 miles 1,075 yards during the year. The accounts show that the financial results of the year have been satisfactory. The net profits, after defraying all charges for cost of production, &c., providing for renewals, sinking fund, and interest on loans, amounts to £17,188 8s. 7d. The committee proposes at an early date to ask the consent of the City Council to further reduce the charges for electricity, provision for such reduction having been made in the current year's estimates. The report continues:—"To meet the ever-increasing demand for supply of electricity, new mains are being laid in various parts of the city, and in the districts of Moss Side, Levenshulme, and Withington. It has further been decided to equip a new generating station on the Bloom Street site, which adjoins the present works, and an order has recently been placed with the Westinghouse Electric Company, Limited, for the supply and erection of four 1,800-kilowatt generators. The necessary buildings, boilers, pumps, pipes, &c., will be put in hand forthwith, and it is expected that the whole of this plant will be available for use by the autumn of 1900. In order to carry out various extensions further borrowing powers will be required, and in accordance with a resolution of the City Council application has been made to the Local Government Board for sanction to raise an additional sum of £500,000. The Board of Trade having notified its consent to an extra high pressure supply of electrical energy on the three-phase system being given by the Corporation under the Manchester Electric Lighting Orders, 1890 and 1896, the Levenshulme Electric Lighting Order, 1897, the Moss Side Electric Lighting Order, 1897, and the Withington Order, 1897, your committee will now be enabled to complete arrangements for the supply of electricity to the several out-districts. Agreements have recently been entered into with the Urban District Councils of Denton, Droylsden, and Heaton Norris for the supply of electricity in their respective districts."

Marylebone.—Prof. Kennedy is to be asked by the Vestry to advise them on terms to be proposed for the protection of the Vestry in the dispute with the Metropolitan Electric Supply Company relating to the breaking up of Edgware Road and Queen Street for laying mains from the Willesden station through Marylebone.

Montrose.—In connection with the Angus Electric Light and Power Company, Limited, it is understood that Messrs. Edmundsons' Electricity Corporation has acquired a site at Blackfriars Street, and operations will shortly commence.

Morecambe.—The District Council is standing in its own light, or rather that of the ratepayers, by making the price of energy prohibitive in the case of some of the public entertainment resorts. The Council charges 7d. per unit to companies which do not use the current all the year round, and amongst these are the West End Pier and the Electric Launch Company. The former has reintroduced gas where possible, instead of paying the extra 2d. per unit, while the Electric Launch Company is going to generate its own current. The ratepayers think the Council would be wiser to sell all it can without making the price exorbitant.

Newport, N.B.—Steps are being taken to form an electric lighting company in Newport. The proposal is receiving considerable support from prominent residents.

Nuneaton.—At a meeting of the Nuneaton District Council on June 29th, the Electrical Committee reported that the electric company offered to sell at the amount of the capital expended, plus £500, which practically meant £5,500, and it further appeared that it would be most likely necessary for the Council to obtain another provisional order. The Committee recommended that, in the event of the Council deciding to purchase, the price should be a sum not exceeding £5,000, but, before agreeing to this, a town's meeting should be called to consider the matter. It was resolved that the sum named by the Committee be offered to the company, and if they refused the matter should drop for a time, but if they accepted a town's meeting should be called.

Peterborough.—A special meeting of the Town Council in committee was held on June 23rd to consider an objection raised by Peterborough Trades and Labour Council to the tender of Edwin Danks, Limited, of Oldbury, Staffordshire, for supplying boilers, on the ground that the firm did not pay the standard rate of wages recognised by the trade society in that district. After some discussion the matter was adjourned.

Portsmouth.—A meeting of the Town Council was held on June 27th to consider the annual report of the Electric Lighting Committee, of which an abstract has appeared in our columns. The chairman of the committee stated that after setting aside £5,340, a profit of 3 per cent. remained; the reserve fund amounted to £14,767. In the course of the discussion objection was taken to the recommendation that £1,000 be paid to the Urban Fund in relief of the rates, but in the end the report was adopted *nem. con.*

Rugby.—At a recent meeting of the Urban District Council it was announced that the Rugby Electric Lighting Bill had received the Royal assent. The Act gives the Council sole rights for two years, but it is said that so few applications for supply have been received that further action is not justified as yet.

St. Helens.—With the building of the new electrical generating station in connection with the refuse destructors at Boundary Road, at the opposite side of the town, the Committee had under consideration the demolition of the Warrington Road station. It is now announced that they have decided to keep the old station working, and are recommending the Council to lay mains from it through the principal streets and roads of the Parr and Sutton districts at a cost of £2,000. The consumers at present connected are to be changed over to the new system as soon as possible after the Cropper's Hill power station is completed and ready for supply, at an estimated cost of £850; and a motor generator, with switch gear, is to be erected at the Warrington Road station at an estimated cost of £750. The town clerk is to apply to the Local Government Board for sanction to the borrowing of the sum of £3,600, the total estimated cost of carrying out the works.

Shoreditch.—Mr. N. Moss, chairman of the Lighting Committee, moved the adoption of the Committee's report at Tuesday's Vestry meeting. The Committee stated that they had considered a report from Mr. Newton Russell on the present practice of switching off the arc lamps at 12·45 a.m., and of lighting the incandescent lamps, which was done with the object of saving expense. The chief electrical engineer suggested that as the advantage would be considerable, and the cost only slightly greater, the arc lamps should be maintained alight throughout the night, and the Committee recommended that the suggestion should be adopted. Mr. H. E. Kershaw, as an amendment, proposed that the consideration of the question should be adjourned for six months, until the financial statement relating to the undertaking had been prepared by the accountant. He had just consulted Mr. C. H. Doughty, the lighting engineer, who thought that the additional expenditure likely to be incurred by the adoption of the proposal would amount to £1,320 per annum, but in the opinion of the speaker the expense would be considerably higher, and would mean an increase of ½d. in the rate. Mr. Steel having seconded the amendment, the chairman of the Committee said that Mr. Kershaw's statements came as a complete surprise to him. The chief electrical engineer had advised the Committee that

the shutting off of the incandescent lamps and the keeping of the arc lamps alight all night would only cost an additional sum of £185 per annum. There was not only the 12s. 6d. as the cost of the incandescent lamps to be considered, but also the £7 12s. 6d. as the price of the automatic switch. The incandescent lamps, of which complaints had been made by the police, might as well be out as alight. Mr. Winkler said the committee were informed on the best authority that the automatic switches did not work properly, and he contended that it was absurd for the glow lamps to be alight in the daytime and extinguished during the night. Mr. Howlett expressed sorrow that Mr. Kershaw was going against the very principle which he had advocated of having more light for the parish. After further discussion the amendment was put to the vote; there were four in favour and the remainder against. The recommendation of the committee was then carried. On the recommendation of the committee an expenditure of £1,140 was sanctioned for the purchase of an additional supply of meters. It was decided to approve the action of the Housing Committee in arranging for the wiring of the staircases of certain model dwellings, so as to enable tenants, if desired, to obtain a supply of electrical energy for a two-roomed tenement at a charge of 8d. per week, and for a three-roomed tenement at 10d. per week.

Southampton.—At a meeting of the Electric Lighting Committee of the Borough County Council last week it was decided, after a lively discussion, that the salaries of the electrical staff should be as follows:—First assistant engineer, increased from £104 to £130, with annual increments of £10 to a maximum of £150; second assistant, increased from £78 to £100, with annual rise of £10 to a maximum of £120; third assistant, increased from £78 to £90, with annual increments of £7 10s. to a maximum of £105. The wages of the drivers, stokers, and switchboard attendants were also raised. The electrical engineer reported that he had communicated with various supply stations where free wiring was in operation, and the replies submitted were, without exception, favourable to the system. The general opinion was that many customers had been obtained who would never have been reached by the ordinary wiring contractor, and that these were usually of the most remunerative kind, being small shopkeepers who used nearly all their lamps until late in the evening. A letter from the National Free Wiring Company, Limited, stated that it was fully prepared, and would prefer, to make arrangements with local firms to carry out the wiring. The consideration of this matter was deferred.

Southport.—A Local Government Board inquiry was held by Mr. C. Perrin, M Inst.C.E., at Southport, on June 30th, with regard to an application made by the Town Council for power to borrow £55,000 for the purpose of electric lighting. The town clerk (Dr. J. D. Williams) stated that the greater portion of the money for which they now sought borrowing powers was for the extension of their electricity plant for lighting purposes. This would account for about £43,000, and the remaining £12,000 was to provide power for working the tramways in the borough. They had applied for powers to construct new tramlines in the borough, and although they had not actually obtained the Parliamentary sanction, they expected to do so within a few weeks. It was necessary to apply a long time ahead, because there was such a congestion in the electrical world that the lines would be ready before the plant could be supplied by the manufacturers. The Corporation had purchased the lines of the Southport Tramways Company so far as they lay within the borough, and leased them back to the company. That company could not use mechanical traction for the working of their lines without the consent of the Corporation, and the Corporation hoped by supplying electricity at a reasonable rate to secure in the company a regular customer for electricity as a motive power. As for the new lines which the Corporation proposed to lay down, they intended to work them by electricity as a Corporation department. There was another company running in the borough, and the Corporation had the power to buy their lines in two years. Mr. C. D. Taite, the electrical engineer, gave evidence as to the nature of the proposed works, and stated that they had plant now of a capacity of 1,275 kilowatts. They proposed to dispose of three small machines, forming the original installation, of a capacity of 125 kilowatts, and in their place put down one large 600-kilowatt alternator. The net profit in the year ending March, 1898, was £640, and in the year ending March, 1899, £2,027. The maximum load last year increased by 187 kilowatts, and as the applications were coming in at a more rapid rate, they expected a still further increase in the coming year. For the purposes of electric traction, they propose to put down two 200-kilowatt alternators.—Mr. R. P. Hirst, borough surveyor, produced the plans of the proposed extensions of the buildings. There was no opposition to the application, but Mr. Alfred Peck, Rawlinson Road, pointed out that it had not been the practice to seal the meters or indicators, and it was open to any dishonest customer to cook his account.—Mr. Taite stated that the strictest orders had been given that all meters and indicators should be sealed.—The inquiry then terminated, and the inspector afterwards visited the works at Crowlands.

Stoke-on-Trent.—The consideration of the surveyor's report upon an installation of electric lighting for Bucknall has been further adjourned, pending a public meeting of the ratepayers of the township with reference to the proposal.

Sunderland.—A meeting of the Lighting Committee was held on June 30th to consider a report by Mr. Snell, the electrical engineer, with regard to extensions. Mr. Snell recommended that the Dunning Street works be enlarged at an outlay of £34,760, made up as follows:—Buildings, £7,000; four 400-H.P. steam dynamos, £12,000; spare armature, £350; condensers and cooling tower, £3,200; traction switchboard, £1,000; five Lancashire boilers, £32,500; two economisers, motor, feed pumps, hot well, &c., £1,000; steam and feed piping, £2,000; coal elevator and conveyor, £1,200; five mechanical stokers, £600; contingencies (10 per cent.), £3,160. The committee adopted the report, and decided to recommend that the extensions be begun at once, that £40,000 be borrowed, and steps taken to secure a site for a second station.

Swansea.—The Ratepayers' Association has, by a majority of five, passed a resolution in favour of the electric lighting of the borough being left to private enterprise.

Taunton.—At the Council meeting last week the Electric Lighting Committee presented the following report:—

After the resolution of the Council on April 25th last, authorising application to be made to the Local Government Board for their consent to a loan of £10,000 for condensing plant, accumulators, and extensions, your Committee considered it advisable to consult Messrs. Kincaid, Waller & Manville, the engineers acting for the Council in laying down the new arc lighting plant, &c., upon some of the items set out in the borough electrician's estimate produced at the before-mentioned meeting. Messrs. Kincaid & Co., made some valuable suggestions, and at your Committee's request, drew up a report with revised estimate. It will be seen from Messrs. Kincaid & Co.'s estimate that, in addition to the condensers, they provide for other plant which will effect a further saving in working expenses, as well as for accumulators and the extensions contained in the estimate of the borough electrician; but the amount of the loan required, namely, £10,000, is not increased. Your Committee recommend the Council to act under the report and advice now given by Messrs. Kincaid & Co., and to accept and pass their estimate in lieu of the estimate passed at the meeting of the Council on April 25th last; and so far as may be necessary, your Committee recommend the rescindment of the resolution passed at that meeting adopting the estimate then produced; and they recommend that application be made to the Local Government Board for sanction to borrow the sum of £10,000, repayable in 30 years by means of a sinking fund, for the works comprised in Messrs. Kincaid and Co.'s estimate. The Council are also asked to sanction your Committee at once obtaining tenders for the condenser and other plant mentioned in the estimate.

Messrs. Kincaid, Waller & Manville's report was of a lengthy character. In relation to the extensions of the station itself, it stated that "to produce the maximum possible efficiency in working, we consider that further economies can be obtained in two directions—(1) by installing a condensing plant in connection with the existing engines; and (2) by installing an economiser to decrease the amount of coal burnt to attain a given result."

Todmorden.—The Town Council has appointed a committee to inquire into the question of electric lighting and traction, but as the gasworks, acquired a few years ago, have just begun to pay, it is somewhat doubtful whether anything will be done in the matter. Todmorden has suffered severely from gas and water monopolies, and is now very jealous of private companies.

Uckfield.—The Rural District Council has received formal notice from Messrs. Verrall & Borlace, solicitors of Brighton, of an application which is to be made to the Board of Trade for a provisional order to supply electricity throughout the parishes of Rotherfield, Buxted and Withyham.

Wellingborough.—The Council has received a letter from the Electric Power Distribution Company urging that the electric lighting matter should be advanced at as early a date as possible. A special meeting of the whole Council in committee was to be held last Monday.

Worksop.—The clerk to the Urban District Council reported that the Worksop Electric Light and Power Bill had received the Royal assent, and was now in operation.

ELECTRIC TRACTION AND MOTIVE POWER NOTES.

Aberdeen.—At a meeting of the Tramways Committee on June 29th it was decided to lay additional cable ducts from the electric works to Market Street, with a view to further extensions, after the opening of the Woodside track. At a meeting on June 30th it was agreed to give Mr. Bell, the electrical engineer, £50 per annum for his work in connection with the tramways, and the Lighting Committee resolved to increase his salary from £225 to £250 per annum.

Bangor.—At a meeting of the Committee of the Privy Council held on June 30th at Dublin Castle, an application on behalf of the Drake & Gorham Electric Power and Traction Company, Limited, was made, praying for an Order in Council authorising the construction of a tramway in the town of Bangor, and from Bangor to Donaghadee. The Right Hon. the Lord Chancellor, and subsequently Lord Justice Fitzgibbon, presided. The routes of the tramways, six in all, were described in detail; the total length of tramways is 10½ miles, and the engineer's estimate of cost is £92,000, including lands, buildings, rolling stock and electrical equipment. The maximum limits of speed proposed are 8 miles per hour through towns and villages, 12 miles per hour along roads where the outside rail is less than 30 feet from the centre of the road, and 25 miles per hour where the tramway is securely fenced off or enclosed.—Sergeant Dodd, Q.C., in making the application on behalf of the promoters, said the scheme had been approved by the County Down Grand Jury, the Bangor District Council, the county surveyor and the Board of Works. There was little or no opposition, objections having been met by alterations in the draft order. Some minor amendments were accepted, and the Council passed the order as amended.

Bradford.—At a meeting of the Tramways Committee on June 28th, the returns showing the results of the working of the electric tramways for the fortnight ended June 25th, 1899, were presented. On the Bolton section 4,720 miles have been run, and the receipts amount to £251 12s. 11d., which is equal to 12·79d. per car mile. The total receipts from April 1st amount to £1,535 11s. 3d., or 12 28d. per car mile. On the Horton section, during the past fortnight, 10,077 miles were run, and the receipts were £684 10s. 4d., which is equal to 16·3d. per car mile. The total receipts from April 1st amount to £3,134 19s. 3d., which is equal to 13 68 per car mile.

Brazil.—An electric railway 15 miles in length will shortly be opened at Manaos. The company carrying out the work is incorporated under the laws of the State of New York, and, as may be guessed, all the machinery, cars, rails, &c., is being supplied by firms in the United States. Manaos is a rising city, and in the exportation of rubber alone will, in a year or two, surpass that of Para, which city, up to 1897, had the bulk of the trade.

Cheltenham.—A public inquiry having been held at Cheltenham by the Light Railway Commissioners into an application for an order to authorise a light railway to be laid through the town of Cheltenham and the village of Prestbury up to the top of Cleeve Hill, the Commissioners have decided to authorise that portion of the railway from Cheltenham to Cleeve Hill, rejecting the greater part of the line within the town of Cheltenham.

Douglas—Ramsey.—The first car to pass over the completed line from Douglas to Ramsey ran on Monday night. In a few days there will be a regular service of cars between Douglas and Ramsey, doing the journey in little over an hour, opening up entirely new scenery to visitors.

Dudley and Stourbridge. — Pending the visit of the Board of Trade official to inspect the line from Dudley to Stourbridge, which has now been electrically equipped, electric cars have been running almost daily for the instruction of the motor men.

Eccles.—The sub-committee appointed by the General Purposes Committee have presented their report to the Council upon the proposal of a syndicate to connect Whitefield, Radcliffe, Little Lever, Farnworth, Worsley, Eccles and the Ship Canal by means of an electrically equipped system of tramways. It has been agreed to support the scheme, and also the action of the Swinton Council with regard to their tramways.

Electric Power for Kalgoorlie Mines.—The financial papers have just given particulars of a scheme which is now in progress for giving a supply of electric current to the leading mines. Prof. Geo. Forbes and Messrs. Belshaw & Co., electrical engineers, have been consulted in regard to the scheme, and a site has been chosen for generating works to the north of and adjoining Boulder City. It is estimated that there would be a saving of nearly £250,000 per annum to the mining industry on a consumption of only 5,000 horse-power, as it would be possible to retail the motive power to the mines at under 4s. per horse-power per day. The revenue to the General Power Company is set down at over £90,000 a year. The lighting of Boulder City, the running of trains for the Government, and the lighting of Kalgoorlie itself are to the proposal incidentals of considerable value.

Glasgow.—The detailed statement of the revenue and expenditure of the Corporation Tramways, for the year from June 1st, 1898, to May 31st, 1899, has been issued. The result of the year's working shows that the revenue amounted to £439,224 1s. 8d., and the working expenses to £318,105 18s. 1d., thus leaving a gross balance of £121,118 3s. 7d. The horse traction receipts amounted to £416,184, and the working expenses to £307,542, while the receipts from the electric cars amounted to £23,039 and the expenses to £10,563. To obtain these results the enormous number of 118,775,668 passengers were carried. The cars run each day averaged 305·85, and the mileage covered was 9,071,640, against 8,483,012 the previous year, at an average rate of 11·46d. per mile, against 11·01d. in 1897-98. At May 31st last, 35 electric cars had been built in the car works, and arrangements have been made for building 60 additional during the current year. As the accommodation in the car works is limited, it has been resolved to give some orders to outside car builders, so that the department may have a sufficient number of electric cars by the time the first considerable section is opened for electric traction. With regard to the conversion of the whole of the tramways to the overhead electric system, the report states that the conversion of the track is now being proceeded with in sections, and increased accommodation is also being provided at several of the depôts, as well as at the Coplawhill car works. The erection of the main generating station at Port Dundas is being proceeded with; and the scheme approved by the Corporation for numerous important extensions, both inside and outside the city, measuring in all 19 miles of double track, includes extensions to Shettleton, Tollcross, Rutherglen, Cathcart, Pollokshaws, Paisley, &c. Satisfactory agreements have been entered into with the authorities concerned.

Halifax.—The electrical engineer to the Halifax Corporation (Mr. H. F. Street) has presented to the Council a lengthy and exhaustive report in regard to the future requirements of the municipality under the altered conditions since the construction of the tramways. He points out that with an extended tramway scheme, sub-stations several miles out of Halifax will be required, and these must be supplied with power by means of polyphase distribution. At present, he says, electricity for lighting is generated at high pressure —2,000 volts—at Foundry Street, and is, by means of transformers fixed at suitable points, transformed to a low pressure—200 volts—which lights the lamps. He suggests that the area thus supplied should be lighted by the direct current, and this would result in all the large transformers being released for other work in distant parts of the town. He asks the Electricity Committee to discuss the following suggestions:—(1) To convert the two 600-H.P. alternators, at an estimated cost of £1,000, into tramway power generators, and to put down new plant for lighting the centre of the town; (2) to change the standard pressure from 100 to 200 volts, thereby doubling (*sic*) the capacity of the low tension network; and (3) to relay the cables in bitumen, thereby more than doubling their life. He points out that if the system were changed, and new direct current machines obtained, these could be used either for tramway or lighting work.

The Tramways Sub-committee having viewed the various routes, has agreed to recommend to the Town Council the construction of the following new lines:—To Elland; from King Cross, along Burnley Road, to Hebden Bridge; to West Vale and Holywell Green; and in Parkinson Lane in the borough.

Lanark.—The County Council has received a letter from the town clerk of Hamilton as to a conference on promoting a scheme of electric or other traction in connection with the more populous districts in the Middle Ward. The letter has been referred to the Committee engaged in dealing with the matter, as it affects Hamilton, Motherwell, and Wishaw.

Leeds—Rodley.—The movement having for its object the extension of the Leeds tramways to the city boundary at Rodley is taking concrete form. A petition for presentation to the chairman and members of the Tramways Committee of the Leeds City Council has been drawn up, and is being numerously signed by the ratepayers and residents of Rodley. The petition points out that the object of the petitioners is to induce the Committee to extend the city tramway system to the borough boundary at Rodley. The hon. secretary of the movement has made arrangements for the deputation appointed at a public meeting to wait upon the Leeds Tramways Committee on the 10th inst.

Leeds—Guiseley.—A deputation from Messrs. Greenwood & Batley attended a joint meeting of the Yeadon and Rawdon District Councils on June 29th, to explain their proposed scheme of tramways from Leeds to Guiseley. The deputation stated that the maximum fare would be 1d. per mile, with certain cars daily at ½d. per mile. The local authorities could purchase the concern at the end of 42 years at its then value. A plan was presented showing the route of the proposed tramway, with branches to Horsforth, Woodside, and Yeadon. It was stated that the Corporation of Leeds would probably extend their system from the present terminus at Kirkstall Abbey to the city boundary to join the new line. After the deputation had retired, the Yeadon Council passed a resolution in favour of the company's scheme; the Rawdon and Horsforth Councils are also favourable to the project, so that it is expected that the three authorities will shortly grant permission to Messrs. Greenwood & Batley to obtain a provisional order.

Liverpool.—An official inspection was made on Tuesday of the electric tramways on the Smithdown Road route by the Lord Mayor and the members of the Tramways Committee of the Corporation. Among those accompanying his lordship were Councillor W. W. Rutherford, chairman of the Tramways Committee, Alderman Fred Smith, deputy chairman, Mr. J. A. Brodie, city engineer, Mr. Holmes, electrical engineer, Mr. Bellamy, tramways manager, Mr. Forbes Higginson, representative of Messrs. Blackwell & Co., and the representatives of Messrs. Dick, Kerr & Co. The lines inspected start at the junction of Upper Parliament Street with St. James Place, and pass along Upper Parliament Street and Smithdown Road to the new car shed on the Richmond Lodge Estate, near the junction of Penny Lane with Smithdown Road. The total length of single track is about 4¾ miles, which, together with the lines already opened in the city, make a total length of 14½ miles now being worked by electric traction. The electric equipment is of the overhead trolley type throughout the route. The power for working the line is obtained from the Smithdown Road destructor. The cars for working the lines are now in course of being built, viz, ten by Messrs. Dick, Kerr and Co., Limited, five by the Westinghouse Electric Company, Limited, and five by the Brush Electrical Engineering Company, Limited. Of this number of cars only four have up to the present time been delivered. The Liverpool Corporation, by their own workmen at the Lambeth Road carriage works, are also constructing six cars, the trucks, motors, and electrical equipment being supplied by Messrs. Dick, Kerr & Co., Limited. The permanent way consists of girder rails weighing 95 lbs. per lineal yard, double-bonded at each joint, and laid on Portland cement concrete. The paving, where new, has been executed with Welsh granite setts, with the exception of a length adjoining the workhouse hospital, which has been laid with West Australian hardwood. The paving of the remainder of the line has been taken up and relaid, new material being added as required. The company left St. George's Church at noon in two special cars, the one in which the Lord Mayor travelled having been built at the Lambeth Road carriage works by Corporation workmen. It was much admired, both as to construction and design, and it was stated to be 4½ cwt. lighter than the electric cars now in use. Reversible seats are provided on the top, and there is accommodation for about 60 passengers, inside and outside. The line is to be opened for traffic next Monday. The trial run was in every way most successful. The party afterwards proceeded to Heathfield, the residence of Councillor Rutherford, and were hospitably entertained by that gentleman and Mrs. Rutherford.—Councillor Rutherford said it would be a fatal mistake to suppose that they could judge from horse traction what were going to be the developments of electrical traction. Nobody could judge in advance what would be the outcome of cheap, rapid, and commodious locomotion for the public. He believed that their estimate of 600 cars for Liverpool would eventually reach 1,200, that their idea of 85 miles of tramway lines would end in 150 miles, and

that the number of passengers would be at least double what they now anticipated. Electric tramways commended themselves to the common sense of the major portion of the community, and the sooner a general system was completed in Liverpool the better for everybody. In submitting the toast of "The Engineers and Contractors, Messrs. R. W. Blackwell & Co., and Messrs. Dick, Kerr & Co.," he declared that at the present rate of progress it would take 12½ years to equip the whole of Liverpool with electric traction. His suggestion was that five or six young engineers should be employed to take charge of different sections of the route. The Corporation themselves might purchase rails, cement, and all materials, and let the whole construction out on mile tenders. By that means the work would be completed within two years.

London, Walthamstow and Epping Forest Railway.—The Great Eastern Railway held a special meeting on 3rd inst., to consider the above railway scheme, which will have connection with the Great Eastern Railway at certain points. Two of the G.E.R. directors will be on the board of the Walthamstow Company. The meeting decided to approve the Bill. It was stated that it was proposed to work the line wholly or in part by electricity.

Lowestoft.—The Light Railway Commissioners have sanctioned the scheme of electric tramways from the harbour to Kessingland, about 5 miles through the southern portion of the borough. A similar scheme for North Lowestoft has been rejected.

Manchester.—It would seem that, after all, Manchester is to carry out the overhead trolley system which has already been authorised by the Corporation. At a special meeting of the Tramways Committee of the City Council, on July 4th, a motion was brought forward in favour of a sub-committee being appointed to visit New York and Washington and inspect the conduit system in those cities, with a view to reporting on its suitability for the central portion of the City of Manchester. After a lengthy discussion the resolution was rejected by seven votes to two. At a meeting of the Council on the following day the action of the committee was confirmed.

Some time ago the Waterworks Committee requested Prof. Kennedy to report on the practicability of utilising the power of the compensation water from the Longdendale Valley. The report has now been issued; after going very fully into details, Prof. Kennedy shows that the capital charges would be so heavy that the cost of production would be nearly double the cost of generation with steam plant. The matter will therefore, no doubt, be dropped.

Mirfield.—At a meeting of the Urban District Council on June 28th notice was given of a motion to approach the Huddersfield Corporation with a view to inducing the latter to extend its tramway system from Bradley through Mirfield to Ravensthorpe.

Newcastle-on-Tyne.—Following his visit to America, Prof. Kennedy has now reported to the New Tramways Committee of the Newcastle Corporation. His advice was asked in regard to the possibility of avoiding overhead wires in the busy centre of the city by the substitution of the conduit system. It is understood that he states that there is no difficulty whatever in working the overhead and conduit systems in conjunction with each other; but as to the advisability of doing so he does not give any definite recommendation. At the same time, he takes occasion to point out that the conduit system is not desirable for any gradients, and is more for the perfectly flat situations of Continental towns. Even the gradient in Grainger Street between the Central Station and the Bigg Market, he seems to think would be a trial for the conduit service.

Nice.—A commencement was made last year towards utilising the considerable water-power of the Nice district for electrical purposes. A company was formed, which at once took in hand the Var, at the point called "La Mescla," where it is confined in a narrow gorge. We read in the *Engineer* that a tunnel was pierced through the solid rock of some 600 metres in length into the Vallon de Fenouillet, where a large reservoir has been formed, and whence the considerable fall thus obtained is about to be utilised by the Electric Tramways Company, which is literally taking possession of the whole littoral, to the great disgust of this aristocratic neighbourhood, and more especially of Cannes, where but one road exists to join the east and west portions of the place, and that a narrow one at the best. Protests, says a consular report, are rife, but have proved useless so far, as far as Cannes is concerned, and at Nice a great effort is being made to save the beautiful boulevards, shaded by fine trees, and bordered by handsome houses, from this invasion.

Peterborough.—Mr. S. Sellon and Mr. Parris, of the British Electric Traction Company, waited on the Peterborough Corporation on June 30th with regard to the widening of Narrow Street, and pointed out the necessity of settling the preamble of the Bill. The company proposed to omit all reference to Narrow Street for the present, in order to get on with the rest of the scheme. Eventually the matter was left over.

Pontypridd.—The District Council has, it is stated, decided to oppose the electric tramway scheme on the ground that having regard to the congested condition of the streets it is inadequate.

Portsmouth.—At a Council meeting on June 27th the Tramways Committee recommended the employment of an expert at an inclusive fee, and of a person to superintend the work in connection with the transfer of the tramways to the Corporation and the introduction of electric traction. As the report of the committee was issued some time ago, and changes had taken place in the meantime, it was decided that it should be withdrawn and a new report presented.

A Record Note.—It is stated that a motor car belonging to the Electrical Undertakings, Limited, with Leitner accumulators and motors, ran from Westminster to Brighton on one charge at an average speed of 12 miles per hour. This is a record, and is the more remarkable seeing that the battery had already run over 500 miles; the run was superintended by two experts.

St. Helens.—The electric tramway is now approaching completion, and an unofficial trial run was made on June 30th at 11 p.m. The trial was perfectly successful, and a steep gradient was overcome without difficulty. The car was in charge of Mr. Highfield, the electrical engineer, and Mr. Isaac Cutler, secretary and manager. Power was supplied from the new electricity works at Boundary Road. Large numbers of people were present at the trial, in spite of the lateness of the hour and heavy rain; and great satisfaction was expressed at the admirable behaviour of the car and machinery.

Spen Valley.—The agreement between the Cleckheaton and Heckmondwike District Councils and the Dewsbury Town Council with reference to the proposed joint electric tramway was on June 27th ratified by the Cleckheaton General Purposes Committee. The agreement pledges the authorities to oppose the scheme of the British Electric Traction Company, Limited, and to promote the joint undertaking by an application to the Light Railway Commissioners in November; and it provides that the undertaking shall be worked by a joint committee of 12, six representing Dewsbury and three each Heckmondwike and Cleckheaton, and that the cost shall be apportioned on the basis of population. The system proposed is the overhead trolley system, and the electrical energy is to be supplied up to the Heckmondwike boundary by the Dewsbury Corporation, and for the remainder by Heckmondwike and Cleckheaton, as may be arranged. Provision is made for local extensions by each authority within its own district, and any matter of difference or dispute is to be referred to the Board of Trade.

Sunderland.—At a meeting of the Tramways Committee on June 26th, it was decided to engage counsel and send witnesses in view of the opposition of the Southwick Urban Council and the North-Eastern Railway Company to the Sunderland Tramways Bill in the House of Commons. The electrical engineer suggested that there should be a shed for cars on each side of the river, and that they should be placed as near as possible to where electric energy is stored for lighting purposes, so that one set of men can look after both lighting and tram locomotion. The consideration of this matter was held over to a future date.

Surrey.—A meeting of a committee constituted to represent the various local authorities in the northern part of the county of Surrey took place at Kingston on Saturday, to further consider the question of providing light railways or tramways in the county. The chairman disclaimed any desire on the part of the Council to control the local authorities in the matter, or to establish lines for its own profit, but pointed out that local lines such as it is suggested to construct in the borough of Kingston and elsewhere would be of little use comparatively unless they were connected, and in regard to this the County Council could render valuable assistance. While desiring to work in amity with the London County Council for mutual advantage, he thought they would all agree that Surrey was quite rich enough and clever enough to establish and manage its own tramways. It was unanimously resolved:—"That, in the opinion of this conference, it is desirable that the Surrey County Council should prepare a general plan and scheme for tramways or light railways for the county, or such parts thereof as it may be deemed expedient to provide with this means of communication, and that the local authorities should be invited to supply the County Council with the particulars of their views and proposals in relation thereto."

TELEGRAPH AND TELEPHONE NOTES.

Telegraphic Interruptions and Repairs:—

Cables.	Down.	Repaired.
Amazon Company's cable—		
Cable beyond Garupa ...	April 4th, 1898 ...	...
Bonny-Cameroun	May 29th, 1899 ...	...
Latakia-Cyprus	June 21st, 1899 ...	...
Para-Maranham	April 10th, 1899 ...	...
Landlines.		
Communication between Salonika and Monastir ...	March 16th, 1899 ...	...
Port au Prince-Jeremie ...	June 14th, 1899 ...	June 29th, 1899

The Telephones Bill.—The following members were added to the Standing Committee on Trade for the purpose of considering the Telephones Bill:—Mr. Bartley, Mr. Bigg, Mr. Griffith Boscawen, Sir C. Cameron, Mr. Cawley, Mr. T. Curran, Mr. Fry, Mr. Hanbury, Mr. Lough, Mr. C. M'Arthur, Mr. Nicol, Mr. J. Redmond, Mr. Strutt, Mr. A. Thomas, and Sir J. Woodhouse.

(*Continued on page* 24)

THE HULL ELECTRICAL TRAMWAYS.

On Wednesday last the Hull electrical tramways were officially opened, the Board of Trade inspectors having provisionally passed the lines on the two previous days. The following was the programme of the inaugural proceedings:—

The members of the Corporation and others were to assemble at the power station, Osborne Street, at 2.30 p.m., and on the request of Alderman Larard (chairman of the Works Committee) the Mayor (Councillor W. A. Gelder) was to open the power station, and Alderman Wilde (deputy chairman of the Works Committee) start the first engine. On behalf of the Corporation the Mayor was to make a presentation to Mrs. Larard in commemoration of the opening of the electric tramways and as an acknowledgment of the able and devoted services of Alderman Larard in promoting the establishment of a system of electric traction for the city.

From the power station the party was to proceed by way of Waterhouse Lane to St. John Street, where Alderman Larard, on the request of the Mayor, was to start the first electric car. The party was then to be conveyed in tramcars over the Anlaby Road and Hessle Road tramway routes, and visit the car shed, Liverpool Street, where refreshments would be partaken of on the invitation of the Mayor. The party was then to return to the city in the tramcars.

Prior to the year 1895 the tramways in the city, with the exception of those on one road which are worked by steam power, were worked by horses and owned by a private company. In 1889 the company was wound up, and an official liquidator appointed by the Court of Chancery. Owing to the dilapidated and extremely defective condition of the tramways, complaints by the inhabitants were made to the Board of Trade, and eventually the official liquidator approached the Corporation with the object of purchase by them. After considerable negotiation the undertaking was purchased by the Corporation in 1895, for the sum of £12,500, which amount included the tramways and depôts but not the rolling stock. The Corporation thereupon decided to apply for powers to construct double lines of tramways in the streets in which the old tramways were laid, and accordingly they obtained a provisional order in the year 1896. This order confirmed the agreement for the purchase of the undertaking from the company, and also enabled the Corporation to work the tramways when reconstructed. Pending the reconstruction of the tramways, they were let to a local contractor at a rental of £100 per annum, the understanding being that, upon the Corporation requiring any section or road, the trams thereon should cease running, to enable the work of reconstruction to be carried out. Before deciding upon the system of electric traction which should be carried out on the new tramways, the Corporation appointed a deputation to visit other cities and towns to inspect the various systems in use, and this sub-committee presented a comprehensive report, in which they recommended the use of the overhead trolley wire system. This recommendation was confirmed by the Corporation, and the city engineer and electrical engineer thereupon prepared specifications for the works. The street works portion comprising two roads, viz., the Hessle Road and the Anlaby Road, was duly advertised to be let by tender, and the tender of Mr. Edward Nicholls, of Morecambe, was accepted. The contractor commenced operations, but after a short period had elapsed financial difficulties overtook him, and the Corporation took the contract out of his hands, and have finished the work with their own staff, under the supervision of Mr. A. E. White, city engineer.

The laying of the first rail took place on June 9th, 1898, the ceremony being performed by Alderman Larard.

The manager is Mr. W. J. McCombe, and the joint engineers are Messrs. A. E. White, M.I.C.E., city engineer, and A. S. Barnard, M.I.E.E., city electrical engineer.

Messrs. Siemens Bros. & Co., Limited, contracted for the electrical and overhead equipment and some motor cars, with Messrs. G. E. Belliss & Co., Limited, as sub-contractors for the engines. The boilers were supplied by Messrs. E. Danks & Co., Limited, Oldbury; the mechanical stokers by T. T. Vicars, Limited, Earlestown; pipe work, &c., by Rose, Downs and Thompson, Hull; electric pumps by Thomas Parker, Limited, Wolverhampton; economiser by E. Green & Sons, Limited, Manchester; rails by the Société Anonyme des Acieries d'Angleur, Liége; additional cars by the Westinghouse Electric Company, Limited, with Messrs. G. F. Milnes & Co., the Brush Electrical Engineering Company, Limited, and the Brill Company as sub-contractors.

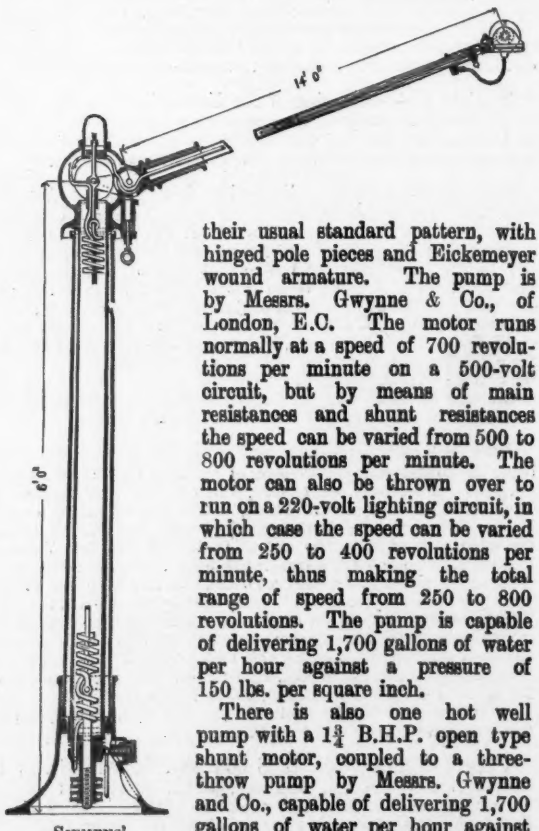
The length of the lines to be electrically equipped includes nine miles of double track, and rather over half a mile of single track. It is divided into six routes radiating in all directions from the centre of the city, but up to the present only two of these routes, or about 3½ miles of double track have been taken in hand and completed.

The generating plant consists of three Siemens H.B. 30/40 traction dynamos, each giving 550 amperes at 500—550 volts. These are coupled direct to Belliss T.E.C. 5 compound self-lubricating engines, giving 470 I.H.P., and for short periods a maximum of 700 I.H.P. when running at 360 revolutions per minute, with a steam pressure of 140 lbs., and exhausting into a condenser with a vacuum of 26 inches. Extra heavy fly-wheels are fitted, and the throttle-valve governor has been carefully designed to secure a very small speed difference with great variation of load.

The boilers are of steel, 30 feet by 8 feet, fitted with Vicars mechanical stokers, which are driven from a shaft connected by worm gear to a Parker 4½-B.H.P. ironclad motor.

The condensing plant consists of a Belliss circular cast-iron surface condenser with gun-metal tubes and having a cooling surface of 2,000 square feet.

The electric pumps consist of one three-throw ram pump driven by a 9 B.H.P. motor by Thomas Parker, Limited, of their usual standard pattern, with hinged pole pieces and Eickemeyer wound armature. The pump is by Messrs. Gwynne & Co., of London, E.C. The motor runs normally at a speed of 700 revolutions per minute on a 500-volt circuit, but by means of main resistances and shunt resistances the speed can be varied from 500 to 800 revolutions per minute. The motor can also be thrown over to run on a 220-volt lighting circuit, in which case the speed can be varied from 250 to 400 revolutions per minute, thus making the total range of speed from 250 to 800 revolutions. The pump is capable of delivering 1,700 gallons of water per hour against a pressure of 150 lbs. per square inch.



Siemens' Trolley Pole.

There is also one hot well pump with a 1¾ B.H.P. open type shunt motor, coupled to a three-throw pump by Messrs. Gwynne and Co., capable of delivering 1,700 gallons of water per hour against a head of 25 feet. By an arrangement of switch gear similar to the above, this motor may be run at speeds varying from 700 to 1,200 revolutions per minute on a 500-volt circuit, and from 350 to 600 revolutions on the 220-volt circuit.

The Wolverhampton firm also supplied the switchboards mounted on teak frames, containing the throw-over, starting, and regulating switches necessary for the above motors.

The condensing water is taken from the Dock some 100 yards away, and an Empire Company's steam air exhauster

is fixed on the suction pipe for starting the circulating pump which circulates the condensing water.

The steam connections to the engines from the main steam range, and the cast-iron exhaust piping to condenser and alternative to atmosphere were supplied and fixed by Messrs. Rose, Down and Thompson, of Hull, who are also supplying a water softener and feed water filter. The remainder of the pipework and the boiler house plant has been executed under another contract.

The economiser is one of Messrs. Green's modern description, containing 256 pipes, equalling 2,618 square feet of heating surface. It is arranged on the maker's modern principle in two groups with a passage between and one round one side of the apparatus, so as to give easy facilities for cleaning, &c. It is made from specially constructed patterns to withstand the high pressure at which the plant is going to work.

The main switchboard consists of three machine panels, two feeder panels, and one panel for the instruments prescribed by the Board of Trade. The panels are of white marble, fixed on iron frames, which are bolted together, the board being thus very adaptable for extensions. With the exception of the switch handles, no wood of any kind is used on the board, thus rendering it perfectly fireproof.

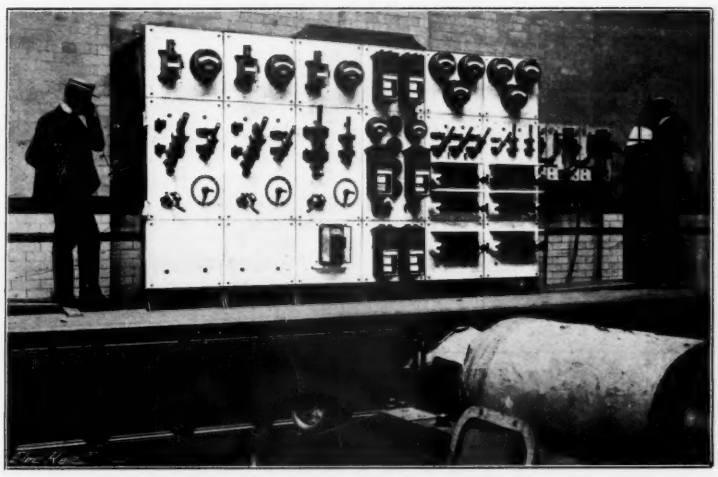
Each machine panel carries on the front:—Weston ammeter, Kelvin electrostatic multicellular voltmeter, main and equalising knife switches, shunt breaking switch interlocked with main switch, shunt regulating switch 25-way.

On one of the machine panels is mounted, in addition, a Thomson-Houston meter with a capacity of 1,500 amperes at 550 volts, measuring the energy supplied to the feeder panels. On the back of the machine panels are the ammeter shunts, positive, negative, and equalising bus bars, cast-iron boxes containing the shunt-breaking resistances, and on one of the panels a set of links for short-circuiting the wattmeter.

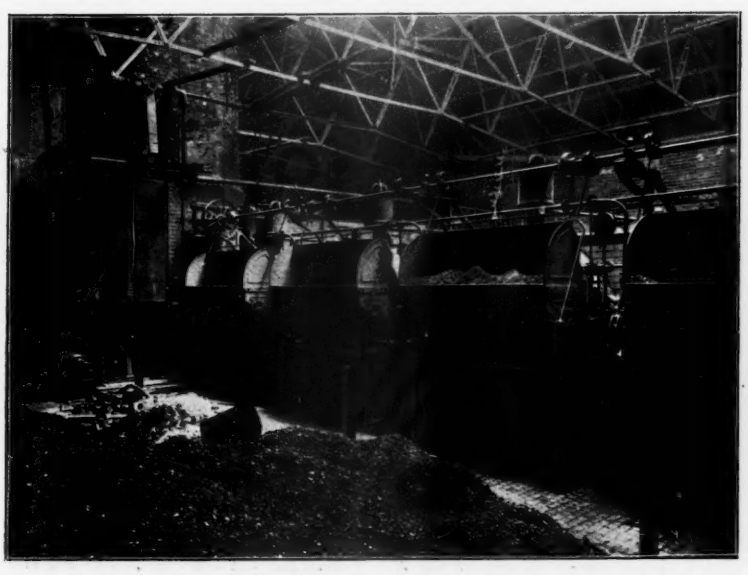
Each feeder panel carries on the front switch gear for three feeders, as follows: Weston ammeters, S.P. feeder knife switches, feeder fuses. These latter are designed with a view to special facility in removing and replacing, the complete fuse being held in spring clips. These latter are protected by porcelain covers, and marble distance pieces are used between the fuses. At the back of the feeder panels are fixed the instrument shunts, positive and negative bus bars, and on one panel a Garton Daniels lightning arrester.

The Board of Trade panel carries on its front:—One recording ammeter, and three recording voltmeters of Messrs. Elliott's make. Two Weston K type ammeters, one having two scales; four multiple way voltmeter switches for recording the pressures at the feeding points, one three-way switch, one two-way D.P. switch. On this panel are also mounted the main recording ammeter

Turner & Drinkwater, HULL TRAMWAYS CAR SHED. *[Photographers.*

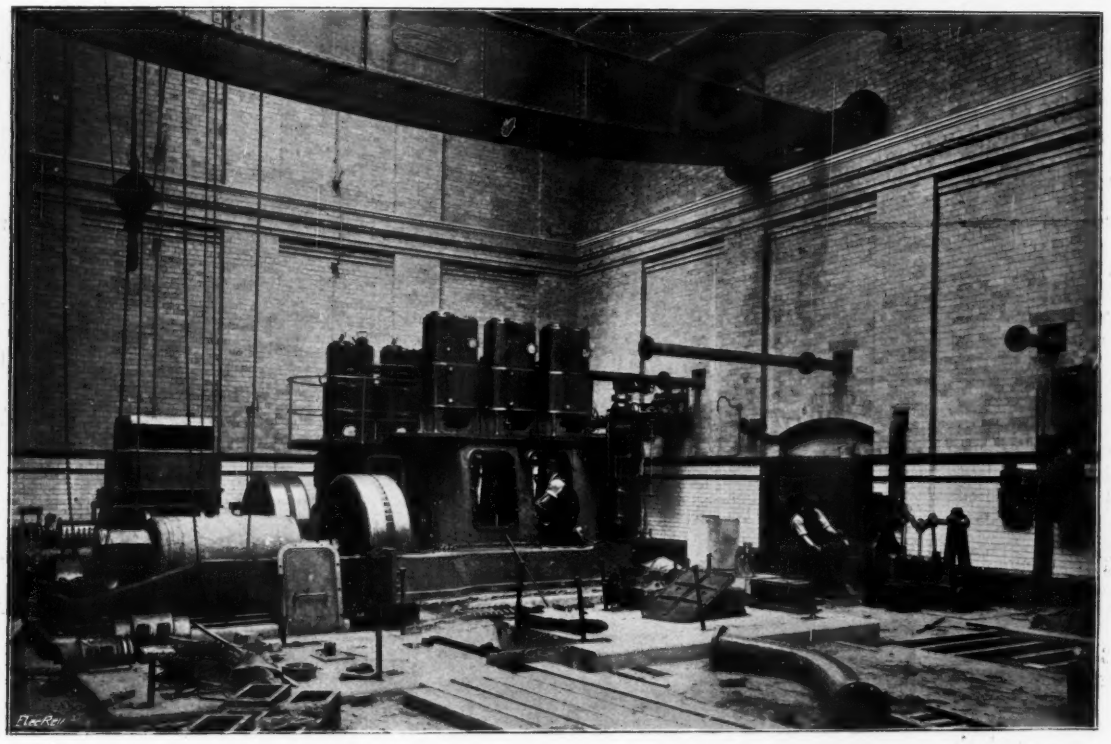


Turner & Drinkwater, HULL ELECTRICAL TRAMWAYS SWITCHBOARD. *[Photographers.*



Turner & Drinkwater, HULL TRAMWAYS BOILER HOUSE.—PARKER ELECTRIC PUMPS ON LEFT. *[Photographers.*

and voltmeter, the former for 1,600 a., and the latter for 550 v., of Messrs. Elliott's make. At the back of this panel are fixed the shunts for the recording ammeters and the negative bus bar.



Turner & Drinkwater, INTERIOR HULL TRAMWAYS POWER HOUSE. *Photographers.*

to the foundation by holding down bolts and connected by tie rods at intervals of 6 feet. They have been rolled by the Société Anonyme des Acieries d'Angleur, Liége. The object of adopting a centre groove is, firstly, to secure even wear on both sides of the rails, avoiding the projecting lip which is often such a serious annoyance to other traffic in worn rails; secondly, to give continuous support to the car wheels when

Turner & Drinkwater, CENTRE POLE CONSTRUCTION IN ANLABY ROAD.—SECTION PILLAR ON RIGHT. *Photographers.*

The rails are of the steel girder double-tread centre groove type, weighing about 96 lbs. per yard; and are laid in 60 feet lengths on continuous sleepers of creosoted redwood screwed

passing the rail joints (which are splayed) and when passing points and crossings; and thirdly, to increase the wearing surface of the head.

In laying the permanent way, after the excavation was completed, the stringers were packed up on bricks at the proper level, clamped tight under the rails, and secured to

Turner & Drinkwater,] Cross Over in Anlaby Road Opposite the Railway Station Gates.—Signal Box on Left. [*Photographers*

Turner & Drinkwater,] Side Pole Construction in Hessle Road.—Westinghouse Car on Line. [*Photographers*

The rails are double bonded at every joint by Neptune bonds of 0·25 square inch section, and are cross bonded at intervals of 180 feet with bonds of ·166 square inch sectional area.

them by dogs. The holding-down bolts and washers were placed loosely in position, and, after the rails had been carefully lined up, the foundation concrete was put in, special care being taken to pack it tight under the stringers.

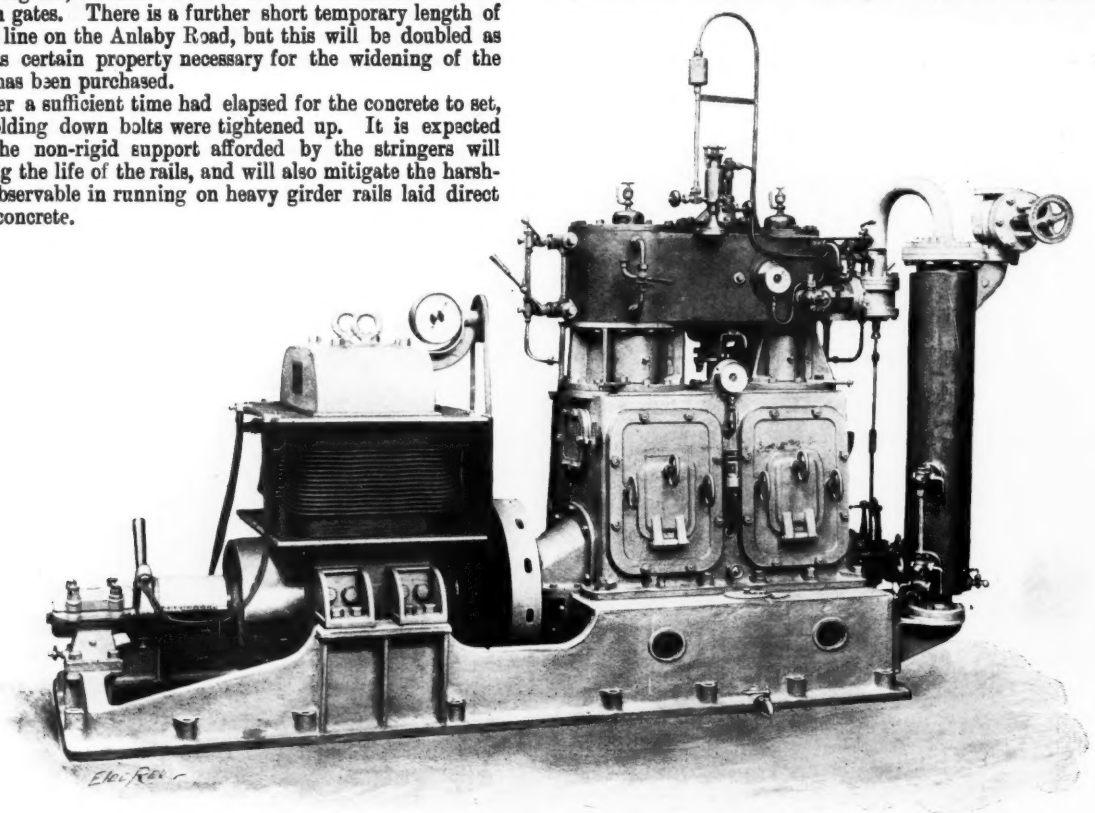
The permanent way will ultimately be double track throughout, except for a length of about half a mile in the narrower streets within the docks and a length of about 80 yards in Midland Street, immediately adjoining the junction of the Hessle Road route with the Anlaby Road route. The latter occurs very inopportunely and has necessitated the use of signals, which are worked from a five-lever box at the station gates. There is a further short temporary length of single line on the Anlaby Road, but this will be doubled as soon as certain property necessary for the widening of the road has been purchased.

Special Work for Anlaby Road Level Railway Crossing.

Rails Ready for Concreting.

After a sufficient time had elapsed for the concrete to set, the holding down bolts were tightened up. It is expected that the non-rigid support afforded by the stringers will prolong the life of the rails, and will also mitigate the harshness observable in running on heavy girder rails laid direct upon concrete.

Double trolley wire of No. 0 B & S gauge is used throughout, supported, with double insulation, by centre poles where the width of roadway exceeds 40 feet, and elsewhere by side brackets on poles erected inside the kerb. In the narrow streets of the old town it is proposed to use span wires instead of poles and brackets. These will be suspended from rosettes attached to the walls of the houses.



Electric Light and Traction Engines.—(See page 24.)

The carriageways throughout the whole length of the tramway routes are being paved with wood from kerb to kerb. The wood is for the most part Jarrah and Karri, but where the traffic is lighter some Baltic redwood is being used. Part of the latter is Haskinized, but the greater part is creosoted. The Australian hardwood has been imported to Hull direct in planks and is being sawn into blocks by a local firm. The blocks are 4⅜ inches deep, and are laid on a bed of cement concrete 7 inches thick faced with fine cement in the usual manner. During the progress of the work already

The poles consist of single wrought-iron tubes of strength proportional to the stresses they are required to bear. Each of them is provided with an ornamental finial and a cast-iron base on which the Hull coat of arms is embossed. The brackets are decorated with ornamental scroll work of wrought-iron.

The trolley wire is divided up into lengths of half a mile by means of section insulators, connection between the sections being made by switch fuses mounted on a marble board inside a cast-iron pillar box. Provision is also made in some of these boxes for feeder connections with the trolley wire, the feeder being put in series with a choking coil, and protected from lightning discharge by an arrester of the Garton Daniels type.

The protection of overhead telegraph and telephone wires where they cross the electric tramway routes, is provided for by guard wires of No. 8 S.W.G. galvanised steel, which are suspended above the trolley wires.

Some interesting work in connection with the overhead line construction will be called for at the drawbridge over the River Hull and the bascule bridge over the lock at Whitefriargate, but up to the present the routes on which these bridges occur have not been proceeded with. We understand, however, that the first named is to be taken in hand very shortly.

The feeder cables consist of copper strand, insulated with Siemens's impregnated fibrous material, lead sheathed, and covered with tape and preservative compound. They are drawn into Doulton conduits, with a cast-iron watertight disconnecting box every 100 yards. Connection is made between the generating station and several points of the rails by means of return feeders of 0·75 square inch section, of a similar type to the positive feeders.

In order to comply with the requirements of the Board of Trade, an insulated test wire is carried to each terminus, and to every point of connection between the rails and return feeders, for the purpose of ascertaining and recording the drop of potential along the uninsulated parts of the "return" path of the current.

The test wire is looped into each of the section boxes mentioned above, in which an earthed terminal is also provided, so as to facilitate the localization of any abnormal drop of potential in the rails by enabling separate tests to be made of the different half-mile sections. The test wires form part of an air space cable which also contains pairs of conductors for the telephone circuits, the whole being lead-covered, and drawn into a separate duct of the feeder conduits. Two or more sets of telephone apparatus are provided at convenient places of call on each route, the central exchange being situated at the tramway power station.

The motor cars, of which 15 are being supplied by Messrs. Siemens Bros. & Co., are mounted on four-wheeled trucks of the Brill 21 E type; the car bodies, which are double-decked, were constructed by Messrs. G. F. Milnes and Co., Limited, Birkenhead. The Westinghouse Company supply 15 motor cars (Milnes), 10 trailers and two sprinklers, 15 motor cars (Brush) with five trailers, and five motor cars (Brill). There are also on order five trailers from the Electric Tramway and Carriage Works, of Preston.

The trucks have a 6-feet wheel base, 14 feet 6 inches spring base, and 30-inch wheels of cast charcoal iron with steel tyres. They are fitted with equalising gear journal boxes, roller bearings and life guards.

The J. G. Brill Company's cars have most charming interiors, the woodwork being very beautiful. The sliding door, too, one half actuating the other, is very convenient. The Siemens-Milnes cars, if not so taking to the eye, are most serviceable-looking vehicles, and the same may be said of the rest.

The Siemens motors are of the enclosed traction type, which has now become universal for tramways. Their armatures have toothed cores and are wound with "formed" coils, which are readily replaceable. The field has four poles, each of which carries a form-wound coil, interchangeable with any other. The magnet case is in two halves, hinged together, and specially adapted for opening easily, besides being provided with two inspection doors. When closed it is practically watertight. The whole is suspended at two bearings from the car axle, and at its other end by a "nose," supported through springs from the bogie framing in the usual manner.

The rated output of one of these motors is 1,100 lbs. pull at 8 miles per hour; which pull can be maintained for 1 hour without any excessive heating. At starting, a much greater effort can be exerted; the gearing is of the single reduction spur type enclosed in an oil-tight case, of a ratio 4·74 : 1.

Special attention has been paid to obtaining as large an output as possible with a minimum weight. The weight complete, including gears and gear case, is 1,900 lbs.

The function of the controllers is to group the motors, either series or parallel, according to the speed desired, to cut out the starting resistance, step by step, and to operate the motors as generators to act as a brake, also to reverse the direction of motion, and to cut out of circuit a defective motor. There are four power steps with the motors in series, three with the motors parallel, and four brake steps. When the controlling handle is on the latter, the motors are generating in parallel with each other through a part of the starting resistance.

The manner in which these changes are effected is novel. The various circuits are made or opened by a number of carbon-tipped switches. These are closed or opened by a series of cams, threaded on the main spindle, and which come into operation successively as the spindle is rotated.

Means are provided for making each position of the handle sensible to the motorman by feel, and the main and reversing spindles are so geared together, that both operate simultaneously in going on to the brake positions and the reversing barrel is immovable except when the main handle is at "off." The weight of each controller is about 2½ cwt.

Each complete resistance consists of three steps, and for convenience is divided into two portions, Steps II. and III. being in one frame, and Step I. in the other. The resistances are built up of spirals of narrow iron or German silver strip, the turns being insulated by thin asbestos strip. These spirals are mounted on a hollow mandrel, insulated by porcelain bushes, and tightened up by nuts on the mandrel. The latter is secured at either end in cast-iron discs, which are bolted to the car body. The terminals are carried on a strip between these discs, and are readily accessible for inspection, the cover being hinged.

The overhead collector gear of the motor cars deserves special mention. The standard, which is of wrought-iron, is of compact appearance, the spring being contained inside the tube, and therefore out of sight, and not liable to accidental injury. The pole, which is of the finest taper steel tube, is pivoted in such a way as to be readily removable. The head of the standard to which it is attached rotates on ball bearings, allowing of a lateral movement of the pole within a radius of about 8 feet from the standard, which is fixed 2 feet 8 inches from the centre line of the car.

The trolley head is of the swivelling type, and attached in such a way to the pole that it will slip off in the event of its being caught up in the overhead line, thus preventing risk of damage to the trolley wire construction or to the car.

Each motor car has two lighting circuits consisting of six 16-C.P. lamps in series, but only five of the lamps on each circuit are actually in use at any time, the two lamps in the canopy head light at the rear end of the car being short circuited by a special plug switch. Two outside lamps on vertical standards attached to the roof with half-opal globes, form a special feature of the cars. The remaining lamps are used for lighting the interior, and as signal lights, with coloured glasses to indicate the route of the car.

The trailer cars, of which there are five included in Messrs. Siemens's contract, are also electrically lighted, current being obtained through a flexible connection with the motor car. Each trailer car has one circuit only, comprising eight 16-C.P. 60-volt lamps in series.

At the end of last week we had an opportunity of going over those portions of the line just opened to the public, under the guidance of Mr. Barnard and his assistant, Mr. Clothier, and to these gentlemen and Mr. White, the city engineer, we are indebted for many of the notes from which our description has been compiled, and for devoting to us much of their valuable time at a moment when everything was being carried on at high pressure. So far as our own experience is concerned, the smoothness of running appeared to be very remarkable, and everything connected with the efficient working of the line seemed to be most complete.

As will be seen from our illustrations, the car house is not quite completed, the power house has only one set running, with a second nearly erected, and foundations for a third, but there is ample space for four more sets when required.

On the right of this picture can be seen the Parker electric pumps, and up above is a Carrick 10-ton traveller.

In the boiler house illustration the other set of Parker's pumps are visible on the left, and in the cross over picture the signal box is represented on the extreme left.

Mr. Barnard, from years of experience, is a strong advocate for the Lancashire type of boiler; he likes a good volume of steam at hand, and we think he is right. His views, also, on the much debated question of combined *v.* separate light and power stations were published on p. 1084 of our last issue.

To Mr. Turner, of the firm of Turner & Drinkwater, our thanks are specially due for the ready manner in which he placed himself quite at our disposal for photographing the various scenes which we present to our readers, some of which were taken under conditions provocative of anything but amiability; but Mr. Turner made light of difficulties, and his unfailing good humour pulled us through.

The townspeople of Hull are to be congratulated on their enterprise, the transition from their present means of getting about being only really appreciated by those who have had to put up with it. One pleasing feature of the Hull tramways is the preponderance of English made goods, which, with one or two exceptions, is quite a new departure in British electrical tramlines.

ELECTRIC LIGHT AND TRACTION ENGINES.

III.

With reference to our last week's article, in which we gave a few illustrations of Robey engines employed in electric lighting work, Messrs. Johnson & Phillips write drawing attention to the fact that two of the alternators shown are of their manufacture. The two-phase alternator shown in fig. 2 (Vol. 44, p. 1070), which was supplied to the North-Eastern Steel Co., has worked so satisfactorily, that Messrs. Johnson and Phillips are doubling the plant there. Incidentally, it may be mentioned that the voltage is 250, and not 2,000, as stated. They also say that the single-phase alternator (fig. 3) was supplied by them to the St. Helens Corporation, the steam consumption per kw.-hour being certified by the consulting engineer, Mr. Robert Hammond, as 25·94 lbs. The figure given by us on page 1069 was 26·9 lbs.

We are now able to give an illustration (see page 22) of the compound enclosed self-lubricating engine, coupled direct to continuous current two-pole dynamos, recently supplied by Messrs. Ernest Scott & Mountain to Messrs. Cammell, of Sheffield, for driving travelling cranes. A few particulars appeared in our last issue.

TELEGRAPH AND TELEPHONE NOTES.

(*Continued from page 17.*)

The Advantages of Open Competition.—The following letter appeared in the *Financial Times* of Tuesday last:—

The Improvement in Telegraphy to South America.

Sir,—I notice under this heading in your issue of to-day that a correspondent draws attention to a great improvement during the past few years in telegraph communication between this country and South America, using this as an antithesis to the lack of improvement in the cabling facilities to Australasia. This comparison is one which your correspondent and others can better make than I. In his letter, the remarks made by "A. E. B." would lead one to believe that the improvement in telegraphy to South America is only due to American competition. This is not correct, as my company, the South American Cable Company, an English company, has also played its part by encouraging the development of the landline service across France and Spain, and in Brazil. This encouragement has in the past seven years met with such success that to-day messages from London to Rio de Janeiro, *viâ* France-Spain-Teneriffe-Norontia and the Brazilian landlines, are correctly and properly exchanged in less than two hours. We shortly hope to reach the Argentine by the same means. This development and the American route have affected the revenues of the old lines to such an extent that their owners have paid much greater attention to their service, and as a consequence the public have benefited. The effect on the revenues has been as follows:—In 1894 the joint revenues of the Brazilian Submarine and Western and Brazilian Companies amounted to £483,298; in 1892, when our route was opened, to £395,738, whereas last year the total was £362,461. These figures give a solid reason for attention to the clients, and have doubtless contributed to the betterment in the South American service which your correspondent has observed. If similar conditions ruled in Australasian business perhaps "A. E. B." is right in assuming that the service to Australia would be improved.

I am, &c.,
South American Cable Company, Limited, E. W. Parsone, *Secretary.*
106, Cannon Street, E.C., *July 3rd*, 1899.

Pacific Cable.—On Monday and Tuesday last Mr. Chamberlain and the Chancellor of the Exchequer met the High Commissioner for Canada, and the Agents-General for New South Wales, Victoria, New Zealand, and Queensland, with a view to examining into the opinions held by the Dominion and the Colonies on the organisation of the Pacific cable scheme. In a few days this conference will be joined by Mr. Tarte, Minister of Public Works in the Canadian Ministry, and Sir Sandford Fleming, who, together with Lord Strathcona and Mount Royal, have been appointed by the Canadian Government as Canada's representatives on the conference. Both in the Government and among the colonial representatives there is a desire to make the scheme as comprehensive and as broadly in keeping with a great Imperial idea as circumstances will allow.

It is reported in the *Daily News* that at the conference held on Tuesday a basis satisfactory to both sides has been reached, and that the general principles on which the scheme is to proceed have been provisionally agreed to. The Colonial Governments will at once be communicated with. Probably a board of delegates will be appointed to settle certain details, and take all preliminary steps. Unless some fresh hitch occurs the cable will be an Imperial affair, in the fullest sense of the words. Those who have consistently advocated the scheme have reason to rejoice that the Government has at last been aroused to a sense of its importance.

In the House of Commons on Tuesday Mr. Hogan (Tipperary, Mid.) asked the Secretary of State for the Colonies whether the business of the approaching conference of representatives of the Imperial and Colonial Governments would be limited to a readjustment of financial responsibilities in connection with the construction and working of the proposed Pacific cable, or whether it was proposed to discuss questions generally affecting the telegraphic service of the Empire.

Mr. Chamberlain, in reply, said the only purpose of the conference is to discuss matters relating to the proposed Pacific cable.

Reduction of Telegraph Rates to India.—On Wednesday of last week Mr. Webster asked the Secretary to the Treasury, as representing the Postmaster-General, if his attention had been called to the present high charges and inequalities in the scale of charges for sending telegrams from the United Kingdom to many British possessions and foreign countries; and if the Government proposed to take any steps to remedy this state of affairs by suggesting an International Conference in regard to them or otherwise. Mr. Hanbury: "The attention of the Postmaster-General has from time to time been called to this matter. He has not received any general representation on the subject, but I understand that communications have recently been addressed to the Chancellor of the Exchequer, by whom, no doubt, they will be carefully considered. With the consent of the companies, considerable reductions were made at the last International Telegraph Conference at Buda-Pesth, and at the next International Telegraph Conference, to be held in 1901, there will be an opportunity for again bringing the charges under review."

As regards this reply, we may remark the year 1901 seems to us to be rather too much in the future, especially when we call to mind that at the Buda-Pesth International Telegraph Conference, although some reductions were made, the companies firmly declined to make any reduction in Indian rates, notwithstanding the pressure put upon them from several sources, notably from the Indian Government Telegraph Department, who, we understand are willing to bear their share in a reduction of the rates. We understand that the proposed deputation to Mr. Balfour, on the subject of cheapening telegraph communication, has been postponed, pending the receipt of despatches from the Government of India.

The Telephone Service.—In the House of Commons the other day, Mr. Kimber asked the Secretary to the Treasury if he, or the Post Office, or any other Government department had made any estimate of the probable return which the State would obtain on the expenditure of the two millions of money in competition with the National Telephone Company, and of its effect on the royalties of £114,000 a year now receivable from the company; whether, for comparison therewith, any estimate had been made of the probable return which would be obtained at once if the company were extinguished or converted into a State department and its capital converted into a stock with a limited interest of 3 per cent.; if so, would he lay a copy of such estimate before the House; and, if no such estimates had been made, would he cause them to be prepared; and would he also lay a copy of the proposed new arrangements with the Telephone Company before the House, and not merely before the members of the Standing Committee. Mr. Hanbury in reply said: The two millions are intended partly for the provinces and partly for London. So far as the provinces are concerned, the expenditure will be chiefly in places where the company is not working or where there is already competition between it and the Post Office. No question of royalty arises in such cases. In London, where there will be competition with the National Telephone Company even if the rates of the company, and therefore the royalty, are reduced, this reduction will, it is anticipated, be more than counterbalanced by the increased number of subscribers. The answer to the second paragraph is in the negative. The proposed new arrangements have already been laid before the House in the usual printed notices.

CONTRACTS OPEN AND CLOSED.

OPEN.

Annfield Plain.—July 18th. The Urban District Council invites tenders for the supply of the necessary plant required

for an installation of electric light for the lighting of their district: (1) For engines and dynamo; and (2) for poles, cables, &c. Particulars on application to Mr T. J. Trowsdale, Surveyor to the Council.

Barton-upon-Irwell.—July 18th. The Guardians want tenders for the electrical plant for lighting their new infirmary buildings at Patricroft. See "Official Notices" this week.

Battersea.—August 31st. The Vestry wants tenders for an overhead travelling crane (hand or electric), and batteries for the electricity works. See "Official Notices" this week.

Brighton.—July 17th. The Council wants tenders for the supply of C.I. water tanks (40,000 gals. capacity) with supporting structure at the electricity works. See "Official Notices" this week for particulars.

Canary Islands.—July 16th. Tenders are being invited until July 16th by the Spanish Post and Telegraph Authorities in Madrid for the concession for the establishment and working of a telephone system between Haria and Arrecife with three intermediate stations on the island of Lanzaroto, Canaries. Tenders to be sent to La Direccion General de Correos y Telegrafos, 10, Calledo Carretas, Madrid, whence particulars may be obtained.

Denbigh.—The North Wales Counties Lunatic Asylum Committee wants tenders for the supply of engines, dynamos, switchboard, injector, piping, and foundations, also wiring of buildings for electric lighting. See "Official Notices" this week.

Dublin.—July 10th. The Richmond District Asylum Committee is inviting tenders for establishing telephonic communication between Portrane Asylum and Broadmeadow Waterworks. Mr. G. C. Ashlin, 7, Dawson Street, Dublin, is the architect.

Edinburgh.—July 18th. The Council wants tenders for installing the electric light at the Central Fire Station, Lauriston. See "Official Notices" June 30th.

Glasgow.—July 22nd. The Corporation wants tenders for boilers, steam engines (main and auxiliary), three-phase generators, continuous current generators, rotary converters, boosters, and static transformers, surface condensers, feed pumps, circulating pumps, and air pumps, all for the electric traction scheme. See our "Official Notices" June 23rd.

Glasgow.—July 22nd. The Corporation wants tenders for 80 electric tramcar bodies to sample and drawing. See "Official Notices" June 23rd.

Glasgow.—August 2nd. The Corporation wants offers for the electric work required in connection with its fire alarm and A B C telegraph systems. Specifications, &c., from the chief officer of the Fire Brigade, College Street.

Halifax.—July 19th. The Corporation wants tenders for a combined steam engine and dynamo. See "Official Notices" June 30th.

Malmo.—September 1st. The Gas Works' directors want tenders for the erection of electricity works for the city. Particulars on application to the clerk of the Gas Works (deposit 12s).

Pembroke.—July 14th. The Electric Lighting Committee wants tenders for a jet condenser with air pump and cooling apparatus. See "Official Notices" June 16th.

Rathmines and Rathgar.—July 14th. The Electric Lighting Committee wants tenders for arc lighting equipment (108 series parallel lamps, posts and switch-gear, &c.), steam and other pipes, jet condenser and cooling apparatus. See "Official Notices" June 16th.

Roumania.—July 15th. Tenders are being invited until the 15th inst. by the Roumanian Post and Telegraph Authorities in Bucharest for the supply of 30 tons of galvanised iron wire. Particulars from, and tenders to, above.

Salford.—July 17th. The Salford School Board wants tenders for the electric lighting of its new schools in Langworthy Road, Seedley Pendleton. See "Official Notices" this week.

Salford.—July 18th. The Tramways Committee wants tenders for the supply of a sample tramcar. See "Official Notices" June 30th.

Salford.—August 8th. The Corporation wants tenders for eight 750-kw. continuous current steam dynamos for electric lighting and traction. See "Official Notices" this week.

South Shields.—July 10th. The corporation wants tenders for the supply and erection of arc lamps and posts. See "Official Notices" June 30th.

Sunderland.—July 24th. The Corporation wants tenders for the reconstruction and electrical equipment of the tramways: (*a*) permanent way, (*b*) overhead construction, (*c*) car bodies and trucks. See "Official Notices" this week.

Wallasey.—July 20th. Tenders are wanted by the Council for alternating current transformers. See "Official Notices" June 23rd.

Wallasey.—July 20th. The Council wants tenders for a 300 kw. alternator with engine combined. See "Official Notices" June 23rd.

Warrington.—July 18th. The Corporation invites tenders for Babcock & Wilcox boilers, economisers, and pumps; high speed engines, direct coupled continuous current dynamos, balancers, and boosters; jet condensing plant, &c.; pipe work; 10-ton crane; switchboard, storage battery, mains, conduits, boxes; arc lamps and posts. See "Official Notices" June 23rd.

West Africa.—July 10th. The Compagnie de Mozambique, of 45, Rue do Alecrim, Lisbon, is inviting tenders until July 10th for the concession for the establishment and working of a central electric power station at Beira for lighting and power purposes during a period of 25 years. Particulars from, and tenders to, above.

CLOSED.

Aberdeen.—The Works Committee of the Harbour Board last week considered a report by Mr. Nicol, harbour engineer, regarding the class of crane which should be provided for the new sheds at Regent Quay. Inquiries, it was stated, had been made at all the principal electric crane makers in the country. After discussing the question, the committee agreed to recommend the board to accept an offer by Messrs. Wimshurst, Hollick & Co., London, to supply three electric cranes at a total cost of £2,450. These, it is expected, could be in position in about five months.

Dewsbury.—The tender of the Callender Cable and Construction Company, Limited, for the extension of the electricity mains to Springfield Terrace, and for a new feeder to be laid in Bradford Road, at the sum of £549, has been accepted by the Gas and Electricity Committee.

Doncaster.—The Electricity Committee has accepted the tender of Messrs. Isles, Limited, of Stanningley, for a 6-ton overhead traveller at £355.

France.—The French Ministry of Posts and Telegraphs have just placed contracts for the supply of galvanised iron wire as follows:—Les Forges de Franche-Comté, 260 tons, 3 mm. dia.; Les Forges de Motor, 100 tons, 3 mm. dia.; and Les Forges de Friminy, 150 tons, 4 mm. dia.

Grimsby.—The Town Council has placed a contract with Messrs. Hewins & Goodland (£11,525) for the erection of buildings for electricity works.

Halifax.—The Guardians have accepted the tender of Messrs. H. H. Nunns & Co., of Halifax, for installing the electric light at the workhouse for £885 14s., and that of Messrs. Fowler, Lancaster & Co, Birmingham, for wiring and fitting the Poor Law offices for the sum of £102 11s. 11d.

Hull.—The tender of the Denaby and Cadeby Main Colliery Company for the supply of six months' coal to the Sculcoates Lane Electric Light Works, has been accepted by the Electric Light Committee.

London.—We print the following letter without comment:—

We notice in your issue of June 23rd that you publish a list of tenders for Mr. Wyndham's new theatre, under specification from Messrs. Owen, Lucas and Pyke, and that it is notified that the Brush Company's tender has been accepted. Their tender is £2,959 10s., ours being £2,734 10s. We think it will be only fair to our reputation if you will kindly state in your next issue that the contract was offered to us, not at the price at which we had tendered, but under the price of the lowest tender, which we declined. We see in your subsequent issue of June 30th, that Messrs. Marryat & Place withdrew their tender of £2,393 10s., as they found they had made an error.

We make no comment, but think it is only fair that these facts should be known.—Yours faithfully,—Strode & Co.

Peterborough.—After a lengthy debate as to labour clauses and rates of wages, the Council has confirmed the Lighting Committee's decision to place the tender for boilers for the electricity works with Messrs. Danks & Co.

Poplar.—The Guardians have accepted the tender of the General Electric Company for the supply of electric motors; the Hart Accumulator Company, for the supply of secondary batteries; Messrs. Speedy, Congden & Co., for the supply of cables, wires, and fittings; and Messrs. Veritys, for the supply of main switchboard and distributing boards.

Warrington.—At a meeting of the Board of Guardians on June 21st, the tender of Warrington District Electric Light and Power Company was accepted for the electric lighting plant and wiring for the new infirmary. A list of the estimates is given below:—

Drake & Gorham	£2,955
Edmundsons, Limited	2,929
Calvert & Co. (amended)	2,793
Warrington District Electric Light and Power Company (accepted)	2,778
Warrington Electric Light Company	2,436

FORTHCOMING EVENT.

Wednesday, July 12th.—At 5 p.m. The Institution of Junior Engineers. Visit to the Shepherd's Bush generating station of the Central London Railway

NOTES.

C.G.S. Names.—Following our note of last week regarding the article in the *Electrical World and Engineer* of New York on "The Desirability of Names for the Fundamental Electric and Magnetic Units," the writer finds two faults with the present system of nomenclature of electrical units. He complains that while the C.G.S. units themselves have no names, they ought to have them; and that the names of the practical units—ampere, ohm, &c.—ought to express the relation between them and the fundamental units from which they are derived. As an illustration one or two names are suggested. For the C.G.S. unit of current "flu" is proposed, and for the ampere (one-tenth of a unit) "deciflu." In the particular case of energy, when the C.G.S. unit has a name, the "erg," it is proposed to call the joule, which is an erg multiplied by 10^7, a septerg. It does not seem likely that any substantial gain would result from such alterations or inventions of names. To take a common case where transformations of units are made. When an analytical problem has been solved, and the results have to be applied to a practical case, it is usually necessary, at least with most memories, to refer to a pocket-book or text-book for the powers of 10 required for each quantity, and this labour might be saved by giving names to the practical units which would enable the memory to recall the power of 10 required. As a matter of fact, however, this particular part of such work is so little troublesome in comparison with the mental strain of stating the original relations, and of the subsequent analytical process, that the change would make no appreciable difference. Such an arrangement does eventually add to knowledge of one kind and detracts from another, and the gain may be useful. It is probably more useful to know that the unit current is one-tenth of the fundamental unit than to recognise the name of Ampere as that of a great electrician, but this sort of advantage is easily exaggerated, while the confusion accompanying the employment of two terms for the same thing is considerable. We may quote a passage from the article. "But there is no necessity whatever to alienate the practical man from the temple of science, the doors of which should always be wide open to those who seek to enter. To give the practical man the quadrant—eleventhetgramme—second unit is to isolate him from real scientific knowledge of the science he applies." This overstates the case. The practical man who is alienated and isolated from the temple of science by talking of amperes, to whom the temple doors fly open on murmuring "Deciflu," is our old friend Aladdin. These word systems are like card houses, quite unsuitable for living in. As the writer of the article judiciously observes, "No harm can be done by the creation of these names. The worst that can happen would be that they should not come into use."

Oil v. Electric Motor Cars.—Enterprising members of Parliament, scorning to use the usual hansom or private carriage to take them to St. Stephen's, have taken unto themselves motor cars, and these are now called into requisition to convey them to the place which "is pigeon-holed and honey-combed with guinea-pigs." The story runs that two wise members travelled in *electric* motor-carriages and were duly admitted to Palace Yard, but a third, who drove an *oil* motor carriage, was only to be admitted minus the carriage, and he accordingly had to alight and foot it. There seem to have been some unpleasant occurrences in the yard with oil vehicles, and the police have since been on the scent with the result aforetold. The announcement that the policeman acted without official instructions does not detract very much from the value of the excellent advertisement that electricity has received, nor can it redeem the character of the oil motor.

Visits to the City of London Electric Lighting Station.—It may probably interest visitors to London to know that on payment of 1s. they may be shown round the Bankside station of the City of London Company. A gallery runs right round the engine room, from which excellent views of the whole of the generating plant may be obtained. The money collected in this way goes towards the employés' sick fund.

Electric Traction.—At the annual meeting of the Incorporate Association of Municipal and County Engineers held at Cardiff, Mr. A. D. Greatorex, of West Bromwich, read a paper, illustrated with diagrams and models of cars, on "Electric Tramway Traction," during the course of which he gave the palm to the overhead system. In the discussion which followed the general opinion seemed to confirm this, though it was admitted that in a few years something even better would be devised.

Gas Accidents.—Perhaps it is as well to record that a gas explosion was responsible for four deaths at the Honley Gasworks, near Huddersfield, on Tuesday. The explosion is supposed to have been caused by a spark from a workman's chisel coming in contact with some unexhausted gas in the holder, which was being removed. When an electric shock fatality occurs at an electricity works there is a good deal said about it, but we think comparative statistics showing the number of accidents and fatalities due to gas and electricity respectively, both at works and on consumers' premises, would afford interesting though gruesome reading.

The Electrical Engineers (R.E.) Volunteers.—This corps will take part in the great Volunteer review before H.R.H. the Prince of Wales on July 8th, on the Horse Guards Parade. They will march past in two companies with the 1st Middlesex R.E. Volunteers, and will number about 116 officers and men. The members will assemble at College Street, Fulham Road, near South Kensington station, at 2 30, in review order, helmet, pouch, water-bottle, and haversack; no leggings. Company drill Monday at 7, Wellington Barracks; Wednesday, 7.15, Wellington Barracks, in undress uniform; Thursday, company drill, 7 o'clock.

Electric Transmission for Brazilian Gold Mines.—The engineer (Mr. George Chalmers) of the St. John de Rey and the Morro Velho Gold Mines, in the State of Minas Garaes, Brazil, is proposing to lay down a large electric transmission of power plant to utilise the energy of some falls near the mines. A continuous current plant has been at work for some time, but the work now proposed will probably be carried out on the multiphase alternating current system.

The Tramways and Light Railways Association.—We have received a circular giving details relating to the above newly-formed association which has been brought into existence with a view to providing an efficient organization to adequately represent all interests in the tramway and light railway industries. The objects of the association may be gathered from the following extracts from the official circular:—

> Extensive applications of electricity to tramways, the encouragement given to the promotion of interurban and other lines by the passing of the Light Railways Act, and the formation of tramway departments by various corporations, have brought new interests and capital into the industry. As all tramway and light railway enterprises, whether promoted by corporations or companies, are initiated under, and controlled by, the same Legislative Acts, they have of necessity many relations in common, and they require some organization capable of expressing and enforcing upon public attention their common views and requirements. There can be no doubt that representations on many subjects require from time to time to be made to Parliament, the Board of Trade, the Light Railway Commissioners and other authorities, and it is obvious that these representations will be made with greater force by a representative association than by separate corporations, companies or individuals.

The association will endeavour to advance the welfare of the industry in such other directions as may seem desirable. The first members of the Council are Messrs. George Richardson, George F. Fry, Emile Garcke, J. Barber Glenn, W. M. Murphy and S. Sellon, all of whom are in the thick of tramway promotion and construction work. Mr. A. M. Wilcox, editor of the *Railway World*, has been appointed honorary secretary, and that journal will be the official organ of the association. Forms are out just now for the first election of members.

Appointments Vacant.—The West Ham Council wants an electrical engineer for designing and supervising the construction of plant and machinery, &c., for electric lighting and traction, at £450 per annum. A shift engineer is also wanted. See "Official Notices" this week.

Appointments.—Mr. J. McFall Smyth, one of the assistants at the Blackburn Corporation electricity works, has been appointed electrical engineer of Keighley.

Mr. C. A. Midgley, chief assistant electrical engineer at Wakefield, has been appointed electrical engineer to the York Corporation.

Obituary. — We learn with great regret of the death of Mr. Thomas Connolly, of Connolly Bros., which occurred on June 21st. Mr. Connolly was a native of Newcastle-on-Tyne, where he served his apprenticeship as a mechanical engineer in the works of Messrs. Armstrong. He migrated to London early in the sixties, and a few years later abandoned mechanical for electrical engineering, being engaged by Messrs. Hooper's Telegraph Company and the Telegraph Construction and Maintenance Company. In 1880 he received an important appointment in Milan, Italy, where he initiated the electrical department of the well-known firm of Messrs. Pirelli & Co. On returning to England he settled in Manchester, where he founded, in partnership with Mr. John Shaw, the successful business of Messrs. Shaw & Connolly, insulated wire and cable manufacturers. This business was subsequently transferred to the Okonite Company, and on the closing of the latter's Manchester works Mr. Connolly retired from active business. He was, however, one of the principal shareholders in Connolly Bros., Limited. He was a man of varied attainments, and was an eloquent public speaker. He took an active part in several political, social, and scientific circles, and was much in demand as a popular lecturer on social and scientific subjects. His funeral was attended by a large concourse of friends and representatives of various societies and public bodies.

Personal.—On the 22nd ult. the electrical staff of the Dublin Electric Tramways Company entertained Mr. R. Humphries, the assistant electrical engineer, at the Royal Hibernian Hotel, on the occasion of his marriage. Mr. J. W. Towle, electrical superintendent, presided. Mr. Humphries was presented with a gold-mounted purse, containing £25 on behalf of the staff. The visitors present included several members of the British Thomson-Houston Company, who are superintending the erection of the plant at the Ringsend station for the D. U. T. Co.

"Half in Shade and Half in Sun."—Last week, in writing on the subject of the Pacific cable, a contemporary refers to "the discouraging effect of Government competition in cable enterprise," while in reference to "competitive telephony," we find that, according to the same authority, "the system will only be at its best when it is controlled, and also managed, by a State department."

CITY NOTES.

The Elmore Companies.

The issue of a circular to the shareholders in a number of Elmore Companies recalls the efforts we made years ago to prevent the waste of money in these undertakings. Years have elapsed, and tangible results for the investor are as far off as ever, but the companies have existed, and the circular bears all the old evidence of sanguine expectations. A Trust Company is to buy up the assets and liabilities of the old companies, to sell the assets to a new company, and to discharge the liabilities. It is unnecessary to follow the maze of particulars which the circular contains in explanation of the complicated arrangement proposed. One cannot but wonder why the various concerns are not allowed to die a natural death, instead of being transformed in the manner proposed. The name is given of a firm who are to provide considerable new capital. Again, it is difficult to understand why a firm, desirous of embarking in the metallurgical business, should not do so without the encumbrance of a company with "a past."

Elmore's Trust, Limited.

On Thursday afternoon last week a collective meeting of the shareholders of Elmore's Patent Copper-Depositing Company, Limited, Elmore's Wire Manufacturing Company, Limited, Elmore's Foreign and Colonial Patent Copper Depositing Company, Limited, and Elmore's American and Canadian Patent Copper Depositing Company, Limited, was held at the Cannon Street Hotel to consider the scheme for the amalgamation of the companies and the formation of Elmore's Trust, Limited, and the English Electro-Metallurgical Company, Limited.

Mr. A. S. Elmore, who presided, said it was with the greatest satisfaction that they came before the meeting to-day to explain something practical to them. Every company had sent in an overwhelming majority of proxies in favour of the scheme of amalgamation which had been before them some time. They had been through troublous times, but they had overcome all the difficulties of putting the four companies on a financial basis, such as was warranted by the merits of the business. They had followed a clear and definite policy all through the matter. They knew that a large sum of money had been put into the French Company by capitalists of well-known business ability, who were convinced that the Elmore process was all that was claimed for it. Since the introduction into the French Company of a large amount of working capital, the business had progressed by leaps and bounds, and had been earning increasing profits year by year, until that day it held a commanding position in the metallurgical world, and had become the premier copper manufacturing company in France. For the year 1898 the French Company had delivered 2,000 tons of tubes, and had made a gross profit of £90,000, with net profits amounting to 12 per cent. on the entire capital. In addition, the Elmore Company of Germany had earned sufficient to warrant the directors paying a dividend of 7½ per cent. on the preference shares. The thing they found they had to do was to try and interest some wealthy people in their business, and that they had succeeded in doing. The result was the scheme which they had had before them, and which he hoped they had all studied. They had valuable patents and large works, but no means of turning them to account. They never really had had any free working capital, which was an elementary condition of success. By the operation of that scheme they would become shareholders in a live company with a working capital of £200,000, with valuable freehold estates, and the whole backed up by the influence of some of the strongest financial houses of London and Paris. Although considerable criticism had been extended to the Elmore Company, and many committees of investigation had been appointed from time to time, in no single instance had anything been brought to light which was not strictly honourable. With regard to the scheme itself, the first thing they had to do was to arrange the basis on which the companies could amalgamate, and that was arrived at after numerous meetings of the various boards, and with the largest shareholders of the companies, and with the shareholders' committee of the foreign company, appointed to consider the question of amalgamation. The second step was to agree with Messrs. Hirsch & Co., and it was due to that firm to state that no unreasonable terms had been exacted. The whole part of that business might be summed up by saying that the Messrs. Hirsch saw it was a good, genuine business, and were prepared to recognise the present shareholders' interest in it; they determined to form an intermediary company called the Elmore Trust. It might be considered a roundabout way of exchanging shares of the old company into a new one, but there were reasons of the greatest weight for carrying this through. The shareholders would at once get their certificates in the trust for the shares they now held, and they would be marketable, he believed, at a premium instead of at a discount. Then they had to pay their debts, and that could be best done by the trust, and by raising money on the debentures they would probably make £100,000, to which had to be added £33,000 which they would receive as their proportion for underwriting preference shares. It had been suggested that they might be unable to pay the interest on the debentures and that the holders would foreclose, but the directors had foreseen that difficulty, and had added enough to the debentures to provide for their interest by sale. However, apart from that they anticipated that the profits would be sufficient. Having referred to the constitution of the board of directors, the chairman said the shareholders would get shares in the trust 33 per cent. more in value than the present shares, and the directors were convinced that they had made an equitable and admirable bargain in the interests of the Elmore shareholders, and it only remained for the shareholders to support the scheme by subscribing for the debenture stock, which should prove an admirable investment. Up to the previous day they had received 188,000 proxy papers from all the companies, which was four-fifths of the total.

Considerable discussion followed, and various questions were asked of the chairman.

In reply, the Chairman said that preferential allotment of debenture stock would be given to the old shareholders, subject to the existing debenture holders who wished to exchange. The existing debenture holders would not have the absolute right of exchange, but they had come forward and lent their money when it was a matter of life or death to the company, and he thought no one would object to them having the choice. Subject to that, the preference shareholders would have the priority. Whether the trust would continue the business or not was entirely a matter for the trust shareholders, and the directors would be entirely guided in the matter by the shareholders. Mr. Jeffrey had asked why the American Company was treated so badly, but he fancied that gentleman was under a misapprehension, for his point

was that the Copper Company's shareholders were getting £1 from £1. As a matter of fact, however, only about a year ago those £1 shares were £2 shares, for the Copper Company reduced their capital. Really every company had received the same, except the foreign company, which got less, because their assets had been parted with to other companies. As to the patents, the original patents had still a period of life, but some were getting towards the end of their life. They had, however, filed new patents from time to time, until they were almost up to date, and if anyone tried to infringe the original patents he wished them joy—he did not think they would begin to do so. Their position from the patent point of view was very, very strong.

The meeting ended without any resolution being passed, but subsequently different meetings of the shareholders of the various companies were held, and resolutions for voluntary winding up were adopted.

The Electric Construction Company, Limited.

The directors' report to be submitted to the shareholders on Thursday, July 13th, 1899, at Winchester House, E.C., at 12.30 p.m., reads as follows:—

			£	s.	d.
The profit of the year ending May 31st last, including the balance of £2,079 0s. 6d. brought forward, is			21,393	6	2
Which your directors recommend should be appropriated as follows, viz.:—					
In providing a dividend of 7 per cent. on the preference shares (to be paid on July 31st next)	£3,500	0 0			
And a dividend of 6 per cent. on the ordinary shares (one-half to be paid on July 31st next, and one-half on January 31st, 1900)	18,452	0 0			
And in adding to the general reserve fund (which will then amount to £20,000)	3,000	0 0			
			19,952	0	0
The surplus of			£1,441	6	2

to be carried to next year's accounts. The buildings and plant have been fully kept up, and £5,000, as formerly, has been placed to the credit of depreciation account—all out of revenue. The depreciation account now amounts to £28,000. The output of the factories goes on increasing, and the high quality of the workmanship and the excellence in design of the manufactures have been fully maintained. The works are full of orders, and to meet the growing demand for electrical plant, contracts have been entered into for a considerable addition to the shops, including tools and general conveniences for the production of the larger class of machines now in demand. The additional equipment, besides tending to economy in production, will facilitate prompt execution of orders. The electrical equipment of the City and South London Railway extension to Moorgate Street has made satisfactory progress, and, it is expected, will be in operation within the next few months. The financial arrangements in progress last year have been completed, and the first and second 6 per cent. mortgage debentures have been converted into 4 per cent. debenture stock. The floating debt of the company has also been largely reduced by the issue of second mortgage debenture stock, bearing 4½ per cent. interest. The compensation paid under the Workmen's Compensation (1897) Act is, for the year, less than £20, and as your directors consider it advantageous for the company to carry its own risk, £150 of last year's profit has been carried to the credit of an insurance fund. The directors who retire by rotation at the general meeting (and who are eligible for re-election) are Sir Henry C. Mance and Mr. Philip Edward Beachcroft. Messrs. James Meston & Co., the auditors for the past year, offer themselves for re-election.

Oldham, Ashton and Hyde Electric Tramway, Limited.

The second ordinary general meeting was held on Monday at the offices, Donington House, Norfolk Street. Mr. Emile Garcke presided, and, in moving the adoption of the report, remarked that the statements of the prospectus had so far been fulfilled. It was true that there had been a little delay in completing the work of construction and in opening the lines for traffic, but this had been almost entirely owing to the delay on the part of the Corporation of Ashton, who had to supply the company with the current, in not being ready with their machinery. There was a considerable demand for electrical apparatus, and he believed that the Corporation of Ashton had found considerable difficulty in getting the plant delivered within the time. The Board of Trade inspection took place on May 25th last. A few points were raised by the Hyde local authorities, but in the main the installation was found quite satisfactory by the Board of Trade, whose certificate, however, which the company received on the 12th ult., was provisional only for three months pending the completion of the few remaining matters that had to be attended to by the contractors. He was assured by the engineer that there would be no difficulty in doing what was required within the three months, when the Board of Trade certificate would become absolute. The Corporation of Hyde claimed that the company had wrongly laid their feeders under the footpath, but the directors had been advised, not only by the engineer, but also by the best legal counsel they had been able to consult, that the company had been quite correct in what they had done. Nevertheless, a writ had been issued by the Hyde Corporation and, curiously enough, the case came on for hearing that day. He was not aware of what had taken place, and it was not advisable for them while litigation was pending to go further into this matter. As he had said, the provisional certificate granted to the company by the Board of Trade was received on the 12th ult., and not a moment was lost in opening the lines for traffic. As a matter of fact, the cars were started as soon as the telegram reached the depôt, and from that day a service of cars over the whole route had been running satisfactorily. They found, however, that they had not sufficient cars to cope with the traffic, and others had been ordered. Since the opening of the lines the receipts had averaged about £450 or £460 per week, which was in excess of the estimates upon which the statements in the prospectus were based; and he believed that when the additional cars were running the receipts would continue as good, if not better. He then referred to the directors' intention to issue, as originally contemplated, £40,000 of debentures at 4 per cent. In all probability the whole of the debentures would be placed in one lot, thus saving the expense of issuing a prospectus or making a public issue. The additional capital would be applied to paying the balance due to the contractors, to enlarging the car department, and to providing for 20 additional trailer cars, and for a small amount of extras on the contracts. They had kept well within the capital estimates, and the debenture money would also leave a small margin of working capital—sufficient, the directors believed, to meet all the company's requirements.

Mr. A. R. Monks seconded the motion, which was carried unanimously.

United River Plate Telephone Company.

The thirteenth ordinary general meeting of the shareholders of this company was held on Wednesday last at Winchester House, Old Broad Street, Mr. J. Irving Courtenay presiding.

In moving the adoption of the report, the Chairman said it was his pleasant duty to congratulate the shareholders on the greatly increased prosperity of the company during the year under review. In the opinion of the company's representatives at Buenos Ayres, in which the directors agreed, there was reason to hope that the handsome advance that had been made in the profits for the past year would be even exceeded in the year they had just entered upon. The indications for continued improvement were, they thought, more reliable than at any previous time in the history of the company. They must bear in mind that the profits had been largely increased of late by the fall in gold, and in making any comparison between the year he was dealing with and the previous years, the considerable appreciation of the paper dollar should not be forgotten. In regard to the improvement in the business of the company, they had now over 8,000 subscribers. That is a gratifying record, and as their representatives were unceasing in their efforts to give satisfaction to their subscribers, and as they would soon have it in their power to much improve the system, they were fully justified in looking forward to a constant extension of their business and addition to the number of subscribers. The most important work they had in hand was the new central office building, which was progressing rapidly and was expected shortly to be ready for use. Referring to the balance-sheet, he said the capital outlay had been increased during the year by £4,693, and they must expect to add to that largely in the future. The reserve fund of £10,000 was a new item which he was sure they were all pleased to notice, and which he trusted would regularly increase. The depreciation fund showed £1,000 increase. The balance brought forward from the previous year was £6,955, and with the profit for the year £33,333, which was nearly £10,000 in excess of last year, gave them the very substantial sum of £40,289 for appropriation. It is proposed to dispose of the profit by putting to depreciation fund £5,000, £2,000 more than last year, making £9,000 in all. From that total it was intended to write off during the present year the whole of the £5,504 now remaining on the credit side of the balance sheet on the account of the conversion of the 7 per cent. debentures and issue of 5 per cent. debenture stock. They next put to reserve fund an additional £10,000, increasing that fund to £20,000, and then after paying a 6 per cent. dividend, £17,400, they carried forward £7,889. He was sure they might congratulate themselves on the accounts.

Mr. F. Green seconded the motion and the report was adopted, and subsequently the following resolution was also agreed to:—

That of the 42,000 unissued shares of £5 each of the company, 40,000 shares shall be preference shares, and shall only be allotted and issued as preference shares.

That such preference shares, if and when issued, shall confer on the holders thereof the right to a fixed cumulative preferential dividend at the rate of 5 per cent. per annum on the capital for the time being paid up thereon, and shall rank, both as regards capital and dividend, in priority to the ordinary shares of the company.

Crompton & Co., Limited.

The eleventh report of the directors, to be presented at the meeting of shareholders at Cannon Street Hotel, on Monday, July 10th, at 3 o'clock, reads as follows:—The directors have pleasure in submitting their annual statement of accounts, made up to March 31st last, from which it will be seen that the net profits for the year amount to £23,074 4s. After providing for debenture interest, the payment of the interim dividend, and the other items set out in the net revenue account, there remains a balance of £15,439 15s. 5d. The directors propose to set aside the sum of £2,000 for doubtful debts and contingencies, to place £5,000 to a reserve fund, to pay a dividend at the rate of 7 per cent. per annum for the half-year, free of income-tax, making, with the interim dividend paid in January last, 6 per cent. for the year, and to carry the balance, £5,131 10s. 5d., forward. The manufactory at Chelmsford has been fully employed during the year, but the output has not kept pace with the orders, and in consequence, the question of the extension of the new works is forced upon the directors, in addition to the erection of the new shops for the manufacture of arc lamps, instruments, and switchboards mentioned in the last report. The contract department has been busy, and the

order book of the company is very full. The increase of business has been satisfactory, and there seems every prospect of its continuing. The policy of employing agents in the United Kingdom has been abandoned, and instead, branch offices controlled by the company have been opened in various centres of trade. This new arrangement has proved a success, by increasing the number of orders at a reduced cost. Moreover, the goodwill of the branch offices belongs to the company and not to agents. In accordance with the articles of association, Mr. Carleton F. Tufnell retires from the board of directors by rotation, but offers himself for re-election. The auditors, Messrs. J. H. Duncan & Co., also offer themselves for re-election.

STATEMENT OF LIABILITIES AND ASSETS AT MARCH 31st, 1899.

CAPITAL AND LIABILITIES.

	£ s. d.	£ s. d.
Authorised issue 54,000 shares at £3	162,000 0 0	
Issued—32,098 shares at £3	96,294 0 0	
Less calls in arrears	344 0 0	
		95,950 0 0
First mortgage 5 per cent. debentures		100,000 0 0
Loans from bankers, secured by deposit of second debentures		87,757 10 7
Sundry creditors		54,964 17 6
Three months' debenture interest accrued		1,250 0 0
Doubtful debts and contingencies account		287 1 1
Unclaimed dividends		26 3 9
Revenue account balance		15,489 15 5
		£305,725 8 4

PROPERTY AND ASSETS.

	£ s. d.
Freehold property	35,695 6 2
Plant, tools, furniture, fixtures, &c.	64,179 8 5
Stock-in-trade and work in progress	88,826 7 8
Trade debtors	76,894 15 10
Investments in shares of other companies	1,684 10 0
Chelmsford Electric Lighting and other subsidiary companies	12,918 16 8
Cash at bankers and in office	3,993 7 10
Patents account	11,533 15 9
Electric cooking and heating department, cost of establishing	3,000 0 0
Goodwill	15,000 0 0
	£305,725 8 4

PROFIT AND LOSS ACCOUNT for the Year ending March 31st, 1899.

	£ s. d.
To Trading expenses (steam and electric power, labour in stores, works salaries and expenses)	17,382 9 2
„ Administration and office expenses, rents, rates and taxes, salaries, advertisements, &c.	8,111 7 2
„ Repairs to buildings and plant	625 5 10
„ Depreciation of plant and machinery, patents and fixtures	4,159 11 9
„ Balance carried to revenue account	23,074 4 0
	£53,352 17 11

	£ s. d.
By Gross profit from trading account, pupils' premiums, and dividends on investments	53,352 17 11
	£53,352 17 11

REVENUE ACCOUNT.

	£ s. d.	£ s. d.
To Interest on debentures		4,394 5 10
„ Interest on bankers' advances		2,742 16 2
„ Directors', managing directors', trustees' and auditors' fees		2,531 5 0
„ Income-tax	£186 1 4	
„ Interim dividend paid January 14th	2,386 18 2	
„ Balance	15,489 15 5	
		18,012 14 11
		£27,681 1 11

	£ s. d.
By Balance from last year	4,606 17 11
„ Net profit from profit and loss account	23,074 4 0
	£27,681 1 11

We have examined the foregoing balance-sheet, with the accounts and vouchers relating thereto, and certify it to be, in our opinion, correct. The stock and work in progress has been certified to us by the secretary and general manager.

J. H. DUNCAN & Co., Chartered Accountants.
Auditors.

39, Coleman Street, London, E.C.
June 29th, 1899.

Electrical Power Storage Company, Limited.

THE directors' report to May 31st, 1899, says that the net profit for the year is £4,532 18s. 4d., which, with a balance of £356 10s. 7d. from last year, amounts to £4,889 8s. 11d., out of which the directors recommend the payment of a dividend of 5 per cent. on the ordinary share capital, which will absorb £4,334 16s., leaving £554 12s. 11d. to be carried forward. The company's buildings, plant, tools, &c., have been maintained in thorough and effective repair and condition at a cost of £3,541 10s. 7d., which sum has been provided entirely out of revenue. The amount of business done during the past year is considerably greater than that of any previous year. The rise in the cost of lead and other materials has prevented the company from obtaining the full benefit of this increased output, and has necessitated the raising of the selling prices. New shops, laboratory, and stores have been erected during the year on the area recently added to the works. With these additional premises the company has only just been able to meet the demand for its manufactures. The retiring director, Sir Daniel Cooper, Bart., offers himself for re-election, also the auditors, Messrs. James Meston & Co. The meeting will be on Thursday next, July 13th.

Thomas Parker, Limited.

THE annual meeting of the shareholders in the above company was held at the works, Wednesfield Road, Wolverhampton, on Tuesday. Mr. C. T. Mander presided.

The CHAIRMAN moved the adoption of the report, which appeared in the ELECTRICAL REVIEW of last week. Mr. Mander said he had a most pleasing task to perform in bringing forward the report of their fifth year's trading. It needed no explanation on his part, except to give a reason for declaring so small a dividend as 10 per cent. They could readily have paid a very much larger dividend if they had thought it wise to do so. But he and the board did not believe in going too fast, and they carried £8,000 to reserve instead of the £2,000 last year. That sum would go into the business and be invested probably in labour-saving machinery, and help to make their working expenses less in the future. He believed in keeping the business on a thoroughly sound basis, and they had thought it wise to pay 10 per cent. only, which was very good indeed. They carried forward £2,439, as against £1,294 last year. They could do with some more debentures, because they could very readily use more machinery in their works than they had at present. Their returns were very good for the last year. They had plenty of orders, and were executing them in a workmanlike and speedy fashion. The chairman added that the directors were absolutely satisfied with the way in which the concern was going at the present time.

Mr. T. PARKER seconded the adoption of the report, and remarked that there was no dark side to the statement. There was no "doctoring" of the report.

The resolution was carried.

A proposal by the CHAIRMAN for the payment of 10 per cent. dividend was agreed to unanimously.

Mr. R. Armistead was re-elected as director. Messrs. Allen, Edwards & Smith (the auditors of the company) were also re-elected. The usual vote of thanks to the chairman closed the meeting.

Greenwood & Batley, Limited.

A MEETING of this company was held at the offices, 16, Great George Street, Westminster, on July 1st, to receive the report of the directors for the year ending March 31st, 1899.

The report stated that the available balance amounted to £25,136 4s. 2d., of which £10,000 was to be put to reserve; dividends of 7 per cent. on the preference, and 3 per cent. on the ordinary shares, were declared, and £2,955 13s. 5d. was carried forward. The works were in good condition and well employed, and the prospects for the current year were satisfactory. The company has acquired an interest in the English De Laval Steam Turbine Company, Limited, from which good results are anticipated.

In moving the adoption of the report, the CHAIRMAN, Mr. A. Greenwood, referred to the arrears of work due to the engineers' strike, which caused great delay during the preceding year, and prevented the profits from being so large as was expected. The customers, however, had been very reasonable, and few orders were cancelled. In view of extensions of the business, and in order to commence the formation of a reserve fund, the directors considered it prudent not to pay a large dividend. The capital account now stood at £255,269. A site adjoining their Leeds works had been leased to the De Laval Company, which was now erecting workshops upon it; an agreement into which they had entered with the above company secured to them the sole rights of selling the turbines in the British Empire, and in China, and Japan, as well as the manufacture of all the dynamos used with the turbines, of which 2,000 were already in use on the Continent.

Mr. R. BATLEY expressed the disappointment of the ordinary shareholders at receiving so small a dividend, and suggested that the reserve should have been built up by degrees.

In reply, the CHAIRMAN explained that Greenwood & Batley's works were entirely closed for seven months during the strike, so that they suffered more than many large firms, whose works were only partly affected.

The report was adopted unanimously.

Major-General Micklem, the retiring director, and Messrs. Peat and Co., the auditors, were re-elected, and Mr. R. Batley proposed a hearty vote of thanks to the chairman and directors, which was carried unanimously. The proceedings then terminated.

British Thomson-Houston Company, Limited.

THE report states that further progress has been made in the winding up of matters in connection with the old company, referred to in the last report. Those losses, which have been determined, have been entirely written off, whilst subsequent losses and contingencies with respect to these contracts taken over from the old company are allowed to stand over against the profits upon other contracts in course of execution entered into by the new company. Such profits accrued on March 31st, 1899, but not taken credit for, are estimated to considerably exceed any loss that may result from the closing of these old accounts. The directors anticipate that before the next general meeting all outstanding matters in connection with the old company will have been cleared off. The profits, after deducting general and technical expenses, discounts, and interest, amount to

£52,090, and the available balance is £29,732. The directors recommend dividends at the rate of 5 per cent. on the "A" and "B" shares, and a further 5 per cent. on both classes of shares.

Prospectuses.

The Metropolitan Electric Supply Company, Limited, has been inviting applications this week for an issue of £125,000, 3½ per cent. mortgage debenture stock at £97. For supplying its present districts the company has already established five generating works, and for the purpose of coping with its increasing business, has recently acquired a large freehold property at Willesden, and is erecting thereon generating works of exceptional importance and magnitude. The site is bounded by two railways, the Grand Junction Canal and Acton Lane, thus offering unusual facilities for obtaining coal and other materials on the most economical terms. The first of the three contemplated sections of the Willesden works, having a capacity of 7,500 H.P. (4,500 kilowatts), will be in operation in the coming autumn. A second section is in course of construction, and the erection of a third section is in contemplation. The estimated total output of these sections will, when completed, amount to 22,500 H.P., or 13,500 kilowatts. The estimated cost of the first section of the Willesden works now nearing completion is £150,000, and the engineer of the company estimates the cost of each of the remaining two sections at approximately a similar amount. The list of applications closed on Thursday.

The Press has contained notices of the prospectus of the City of Carlisle Electric Tramways Company, Limited, which has been floated with a capital of £60,000 in £1 shares, and £40,000 4 per cent. debenture stock. The routes of the railway radiate from the centre of the city to the suburbs, and comprise a total length of 7¼ miles of track. The list closed on Wednesday.

Electric Construction Company.—The directors have resolved to recommend a dividend on the ordinary shares for the year ended 31st ult. at the rate of 6 per cent. per annum, one half payable on 31st prox., and the other half on January 31st, 1900.

Cape Electric Tramways, Limited.—The directors announce an interim dividend of 3½ per cent., free of income-tax, payable on the receipt of the transfer returns from South Africa. The transfer books will be closed from 6th to 11th prox., inclusive.

TRAFFIC RECEIPTS.

The Blackpool and Fleetwood Tramroad Company.—The receipts for the week ending July 1st, 1899, were £768 0s. 3d.; aggregate to date, £10,089 8s. 4d.

The Bristol Tramways and Carriage Company, Limited.—The receipts for the week ending June 30th, 1899, were £3,214 11s. 7d.; corresponding period 1898, £2,884 11s. 1d.; increase, £330 0s. 6d.

The City and South London Railway Company.—The receipts for the week ending July 2nd, 1899, were £980; week ending July 3rd, 1898, £988; decrease, £8. Miles open, 3½.

The Dover Corporation Electric Tramways.—The receipts for the week ending July 1st, 1899, were £210 14s. 6d.; week ending July 2nd, 1898, £182 19s. 4d.; increase, £27 15s. 2d. Total receipts to date, 1899, £4,231 18s. 6d.; corresponding period, 1898, £3,339 0s. 11d.; increase, £892 17s. 7d. Miles of track open week ending July 1st, 1899, 3; week ending July 2nd, 1898, 3. Car miles run week ending July 1st, 1899, 4,476; week ending July 2nd, 1898, 3,629. Number of cars, week ending July 1st, 1899, 11; week ending July 2nd, 1898, 10.

The Dublin United Tramways Company.—The receipts for the week ending Friday, June 30th, 1899, were as follows:—D. U. T. Co., horse cars, £2,332 19s. 6d.; ditto, electric cars, £1,317 6s. 3d.; D. S. D. Co., electric cars, £1,036 12s. 5d.; total, £4,586 18s. 2d.; corresponding week last year—D. U. T. Co., horse cars, £2,937 2s. 1d.; ditto, electric cars, £558 19s. 4d.; D. S. D. Co., electric cars, £773 11s. 9d.; total, £4,219 13s. 2d.; increase, £367 5s.; aggregate to date, £95,419 6s. 3d.; ditto last year, £89,276 16s. 3d.; increase to date, £6,142 10s. Worked:—The mileage open is 18 miles electrically, 26 miles by horses, as against 11 miles electrically, and 31 miles by horses, for the corresponding period last year.

The Liverpool Overhead Railway Company.—The receipts for the week ending July 2nd, 1899, amounted to £1,462; corresponding week last year £1,566; decrease, £104.

The South Staffordshire Tramways Company.—The receipts for week ending June 30th, 1899, were £694 8s. 2d.; aggregate receipts for 26 weeks, £16,520 8s. 9d.; week ending July 1st, 1898, £700 7s. 10d.; aggregate receipts for 26 weeks, £15,801 10s. 7d.

STOCKS AND SHARES.

Wednesday Evening.

With the holiday season softly settling down over the electric lighting market, in company with other departments of the Stock Exchange, we seize an opportune moment in which to sum up a few of the leading changes during the past half-year. That these should be mostly in the nature of small declines (City of London being the only violently affected member of the group) is not very surprising when one considers the eager boom of last year, which at the beginning of 1899 was rapidly subsiding. From the most prominent electric lighting companies we take the following list:—

Company.	January 3rd.	July 3rd.	Rise or fall.
Bournemouth and Poole ..	11½	13½	+ 2
Brush Electric	1⅝	1⅝	+ ⅛
Charing Cross	12	11	− 1
Chelsea	9½	8	− 1½
City of London	23	15	− 8
House-to-House	9½	8	− 1½
London Electric	3⅛	3⅜	+ ⅛
St. James's	16½	17	+ ½
Westminster	16	14½	− 1½

No account has been taken of dividend distributions, and when these are allowed for, the electric lighting market will be found to have suffered, after all, very little loss. The fear of Vestry competition has latterly been heard very little of, and we see no reason why the course of the market should not show a steady improvement between this and New Year's eve.

In the little electric railway section the feature has been the heavy fall in Waterloo and City stock. The reason for this is the policy adopted at the first by the directors in not publishing the traffic receipts separately, but lumping the returns with those of the London and South-Western Company. Reports got about that the line was doing badly, and a good deal of stock was pressed for sale on the Stock Exchange.

Here is our list:—

Company.	January 3rd.	July 3rd.	Rise or fall.
City and South London ..	68	68	..
Central London	10	10⅜	+ ⅜
Do.	6 (£6 paid)	8¾ (£8 paid)	+ ⅜
Waterloo and City	112½	105½	− 7

Central Londons have been bought by those who anticipate great things from the opening of the line. Metropolitan Districts are 3 points down since the first business day of the year, the Metropolitans have fallen 8½.

Traction shareholders will contemplate with equanimity the list of representative securities which we have selected; in only one case has a fall to be noted, and that was not astonishing. The rapid strides made with electric traction and light railways in this country and all the world over, have led to a series of substantial rises, which, in most cases, are fully warranted.

Company.	January 3rd.	July 3rd.	Rise or fall.
Barcelona Trams	12½	16	+ 2½
Buenos Ayres and Belgrano ..	2	3⅛	+ 1⅛
British Electric Traction ..	16	18½	+ 2½
Imperial Trams	17	25	+ 8
New General Traction	5	4	− 1

The advance in Barcelona as in Bordeaux tramway shares is due to the fact that both companies will, in all probability, be acquired by the respective Governments of the countries in which the undertakings are situated, but British Electric and also Imperial Tramways shares are both higher owing to the development in electric traction just referred to. The telegraph record runs:—

Company.	January 3rd.	July 3rd.	Rise or fall.
Anglo-American "A"	17	13½	− 3
Commercial Cable	185	192½	+ 7½
Cuba Submarine	10½	9½	− 1
Eastern	176	160	− 16
Eastern Extension	17⅞	16	− 1
Reuters	7⅞	7½	None
Globe Telegraph and Trust ..	12⅞	11¼	− 1½

The one company whose stock stands higher now than it did at the beginning of the year is the Commercial Cable, which is an American concern, and little affected by the causes that shake the London market. Eastern Telegraph stock has been as low as 156 this year, and as high as 183¼. It was rudely upset, in the first place, by the wireless scare, and has lately had the Pacific cable as a thorn in its flesh. National Telephones have lost a few shillings since the year began.

In the manufacturing division Babcock & Wilcox have risen over 10 points during the period under review, but Edison & Swan have declined ½. Electric Construction exhibit no change. Callender's Cable are 4½ to the good, and Henley's Telegraph Works are up £2 10s. per share.

In none of the examples quoted have dividends been calculated.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1896.	1897.	1898.	Closing Quotation, June 28th.	Closing Quotation, July 5th.	Business done during week ended July 5th, 1899. Highest.	Lowest.
124,400£	African Direct Telegraph, 4 % Debs.	100	...	...	...	101 —105	100 —104 xd	...	...
25,000	Amazon Telegraph, shares	10	...	...	...	3 — 4	3 — 4	...	...
125,000	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	...	...	...	85 — 90	90 xd	...	...
905,560£	Anglo-American Telegraph	Stock	£2 13s	3 %	£3 9s	61 — 64	61 — 64	62¾	61¼
3,047,220£	Do. do. 6 % Pref.	Stock	£5 6s	6 %	6 %	111½—112½	112 —113	113	112
3,047,220£	Do. do. Deferred...	Stock	...	...	18s. %	12½— 13	13¾— 14¼	13 1/16	12⅞
205,151	Brazilian Submarine Telegraph	10	7 %	7 %	...	15¼— 15⅝	15 — 15⅛xd	15 7/16	15 3/16
75,000£	Do. do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	110 —114	108 —112 xd	...	...
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	4 %	...	2½— 3	2½— 3	...	...
10,000,000$	Commercial Cable	$100	8 %	8 %	8 %	185 —192	190 —195 xd	192½	191½
1,332,523£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	104 —106	104 —106 xd	105⅜	103⅛
224,850	Consolidated Telephone Construction and Manufacturing	10/-	2 %	1½ %	...	⅛— ¼	⅛— ¼	...	...
16,000	Cuba Telegraph	10	8 %	7 %	8 %	9 — 10	9 — 10	9⅛	9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	18½— 19½	18½— 19⅜	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	...	4 — 5	4 — 5	4	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	...	9½— 10½	9½— 10½	...	...
30,000	Do. do. 4½ % Debs.	50	...	...	...	105 —109 %	103—107 % xd	...	...
60,710£	Direct United States Cable	20	3 %	3¼ %	...	11½— 12	11⅜— 12¼	11⅜	11 9/16
120,000	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	102 —105	100 —103 xd	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	6½ %	7 %	...	163 —168	153 —158	166½	152
1,795,000	Do. 3½ % Pref. Stock	100	...	...	...	100 —104	100 —104	103	100
89,900	Do. 5 % Debs., repayable August, 1899 ...	100	5 %	5 %	...	101 —104	101 —104	...	...
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	...	118 —122	115 —120	116	115
250,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	7 %	16 — 16½	15½— 15⅝	16⅜	15½
16,200£	Do. 5 % (Aus. Gov. Sub.) Deb., 1900, red. ann. drgs., reg. 1—1,049, 3,976—4,826	100	5 %	5 %	...	100 —104	99 —100 xd	...	...
64,400£	Do. do. Bearer, 1,050—3,975, 4,327—6,400	100	5 %	5 %	...	101 —104	100 —103 xd	...	...
320,000£	Do. 4 % Deb. Stock	Stock	4 %	4 %	...	120 —124	118 —123	...	...
35,100£	Eastern and South African Telegraph, 5 % Mort. Deb., 1900 red. ann. drgs., Reg. Nos. 1 to 2,343	100	5 %	...	...	101 —105	99 —103 xd	...	...
46,500£	Do. do. do. to bearer, 2,344 to 5,500	100	5 %	...	...	102 —105	100 —103 xd	102	...
300,000£	Do. 4 % Mort. Debs., Nos. 1 to 3,000, red. 1909	100	4 %	...	...	103 —106	103 —106	...	...
200,000£	Do. 4% Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	4 %	...	...	102 —105%	102 —105%	102	...
180,227	Globe Telegraph and Trust	10	4½ %	4½ %	5½ %	11 — 11½	10⅜— 11½	11⅜	10 13/16
180,042	Do. do. 6 % Pref.	10	6 %	6 %	6 %	15½— 15⅝	15½— 15⅝	15½	...
150,000	Great Northern Telegraph, of Copenhagen...	10	10 %	10 %	...	31½— 32½	31 — 32	31½	...
83,500	Halifax and Bermuda Cable, 4½% 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	101 —104	100 —103 xd	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	53 — 56	52 — 55	...	...
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	6 %	6 %	...	109 —112	109 —112	...	...
71,000	Montevideo Telephone, Limited, Ord., Nos. 1 to 71,000 ...	1	...	...	...	¼— ½	¼— ½	...	...
84,000	Do. do. 5% Pref., Nos. 1 to 84,000	1	...	...	...	¾— 1	¾— 1	...	...
490,000	National Telephone, 1 to 490,000	5	5½ %	6 %	6 %	4¾— 5¼	5¼— 5⅜	5⅜	5⅛
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	11 — 13	12½— 13½	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	11 — 13	12½— 13½	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4¾— 5¼	5¼— 5⅜	5⅜	5¼
1,329,471£	Do. 3½ % Deb. Stock Red.	Stock	3½ %	3½ %	3½ %	100 —103	99 —102	100½	...
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	5 %	⅞— 1	⅞— 1	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	4 %	4 %	...	105 —108	103 —106 xd	...	...
11,839	Reuter's	8	5 %	5 %	...	7 — 8	7 — 8	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	130 —135	130 —135	...	...
58,000	United River Plate Telephone	5	5 %	6 %	...	5 — 5½	5 — 5½	...	...
151,733£	Do. do. 5 % Debs.	Stock	...	...	...	105 —108	103 —106 xd	...	...
200,000£	West African Telegraph, 5 % Debs.	100	5 %	5 %	...	100 —103	100 —103	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	½— 1	½— 1	...	...
150,000	Do. do. 4% Debs., 1—1,500 gua. by Braz. Sub. Tel.	100	...	...	...	103 —106	101 —104 xd	...	...
339,521	Western and Brazilian Telegraph 4 % Deb. Stock Red. ...	Stock	...	...	...	105 —108	103 —106 xd	105½	...
88,321	West India and Panama Telegraph	10	1 %	⅝ %	...	1½— 1⅝	1½— 1⅝	1 3/16	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	6 %	6 %	...	10½— 10⅝	10½— 10⅝	10⅝	10⅜
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	6 %	6 %	...	8½— 9½	8½— 9½	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	...	105 —108	103 —106 xd	...	...
158,100£	Western Union of U.S. Telegraph, 6 % Ster. Bonds ...	100	6 %	6 %	...	100 —105	100 —105	...	...

ELECTRICITY SUPPLY COMPANIES.

30,000	Charing Cross and Strand Electricity Supply	5	6 %	7 %	8 %	10½— 11½	10 — 11	11¼	10⅝
20,000	Do. do. do. do. 4½ % Cum. Pref.	5	...	...	...	5¾— 6¼	5¾— 6¼	...	..
34,000	*Chelsea Electricity Supply, Ord., ...	5	5 %	6 %	6 %	8 — 9	7½— 8¼xd	8	7⅞
100,000	Do. do. do. % Deb. Stock Red....	Stock	4½ %	4½ %	...	112 —114	112 —114	...	...
60,000	City of London Electric Lighting, Ord. 40,001—100,000 ...	10	7 %	10 %	6 %	14 — 16	15 — 17	15⅞	14
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	13 — 15	13 — 15	14	...
400,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	5 %	...	125 —130	123 —128 xd	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	*nil*	*nil*	*nil*	11 — 12	11 — 11½	11 5/16	11¼
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	14 — 15	14 — 15	...	...
220,000	Do. 4½ % Deb. Stock, Prov. Certs (£60% to be paid) Rd.	...	...	...	...	54 — 56	52 — 54 xd	53	...
17,400	Edmundsons Elec. Corp., Ord. Shares 1—17,400	5	...	5 %	...	5¼— 5⅝	5¼— 5⅝	...	...
19,661	House-to-House Electric Light Supply, Ord., 101 to 19,661	5	...	4 %	6 %	7½— 8½	7½— 8½	7⅝	...
12,000	Do. do. 7 % Cum. Pref. ...	5	7 %	7 %	...	9 — 10	8½— 9½	...	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	3½— 4	3½— 4	3 13/16	...
48,050	Do. do. do. 6 % Pref.	5	...	...	6 %	6½— 7	6½— 7	6¾	...
100,000	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	104 —106	104 —106	...	...
62,500	Metropolitan Electric Supply, 101 to 62,500	10	5 %	6 %	5 %	16½— 17½	16½— 17½	16⅝	...
22,500	Do. Nos. 62,501 to 85,000	10	...	...	...	15½— 16½	15½— 16½	...	...
220,000£	Do. 4½ % First Mortgage Debenture Stock	...	4½ %	4½ %	...	118 —121	117 —119 xd	...	...
6,452	Notting Hill Electric Lighting	10	4 %	6 %	6 %	16 — 17	16 — 17 xd	...	...
31,980	St. James's and Pall Mall Electric Light, Ord.	5	10½ %	14½ %	14½ %	17 — 18	16½— 17½	17¼	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	9 — 10	9 — 10	...	...
65,000	South London Electricity Supply, Ord., £4 paid	5	...	...	...	4½— 4⅝	4½— 4⅝	...	...
79,900	Westminster Electric Supply, Ord., 101 to 80,000 ...	5	9 %	12 %	12 %	14 — 15	14 — 15	14 15/16	14⅝

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid. ‖ Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1896.	1897.	1898.	Closing Quotation June 28th.	Closing Quotation July 5th.	Business done during week ended July 5th, 1899. Highest.	Lowest.
60,000	Aluminium "A" shares, Nos. 1—60,000	1	10 %	10 %	...	3¼— 3⅜	3¼— 3⅜	3 7/16	...
90,000	Do. 4½ % 1st Mort. Deb. Stock Red.	Stock	...	...	...	95 —100	95 —100	...	...
80,000	British Electric Traction	10	...	...	6 %	18 — 19	18 — 19	18½	...
10,000	Do. do. 6 % Cum. Pref. 30,001—40,000 (issued at £2 10s. prem. all pd.)	10	...	...	...	14 — 14½	14 — 14½	14½	14⅜
20,000	Do. do. do. Nos. 40,001—60,000	10	...	...	...	13⅜— 14¼	13⅜— 14¼	14⅜	...
200,000	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	126 —129	126 —129	128¼	...
90,000	Brush Elecl. Enging., Ord., 1 to 90,000	3	*nil*	*nil*	...	1⅞— 2	1⅞— 2⅛	...	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	*nil*	4 %	...	2⅛— 2⅜	2⅛— 2⅛	2 5/16	2 3/16
125,000*l*	Do. do. 4½ % Perp. Deb. Stock ...	Stock	...	...	...	110 —114	110 —114	...	...
50,000	Do. do. 4½ % 2nd Deb. Stock Red. ...	Stock	...	...	...	103 —106	103 —106	...	...
20,000	Callender's Cable Construction shares, Nos. 1—20,000 ...	5	10 %	12½ %	15 %	14 — 15	14 — 15	14¾	14¼
90,000	Do. do 4½ % 1st Mort. Deb. Stock Red.	Stock	...	...	...	114 —117	112 —115 xd	...	...
35,250	Central London Railway, Ord. Shares	10	...	...	...	10½— 11	10½— 11 xd	10¾	...
178,303	Do. do. do. £8 paid	10	...	...	...	8½— 9	8½— 9 xd	...	...
61,033	Do. do. Pref. half-shares £3 paid ...	...	...	...	...	3 — 3½	3 — 3½xd	3½	...
71,447	Do. do. Def. do. £5 paid ...	...	...	...	...	5½— 6	5½— 5¾xd	...	...
630,000*l*	City and South London Railway	Stock	1 1/16 %	1 1/16 %	2⅛ %	67 — 69	67 — 69	68½	...
22,500	Do. do. Ord. shares, Nos. 1 to 22,500 £5 pd.	10	...	...	...	4¾— 5½	4¾— 5½	...	...
32,098	Crompton & Co., Nos. 1 to 32,098	3	...	...	...	3¾— 4¼	3¾— 4¼	...	...
100,000	Do. 5% 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	...	...	...	...	99 —102	99 —102 xd	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	5⅛ %	6 %	...	2 — 2⅛	2 — 2⅛	...	...
17,139	Do. do. do. "A" Shares, 01—017,139	5	5⅛ %	6 %	...	4 — 5	4 — 5	4½	...
344,023	Do. do. do. 4 % Deb. Stock Red. ...	100	...	...	...	97 — 99	95 — 97 xd	96	...
112,100	Electric Construction, 1 to 112,100	2	5 %	6 %	6 %	2⅛— 2⅜	2 — 2⅛	2 5/16	...
25,000	Do. do. 7 % Cum. Pref., 1 to 25,000 ...	2	7 %	7 %	7 %	3 — 3½	4 — 5	3 5/16	...
140,300	Do. do. 4% Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	103 —106	95 — 97 xd	...	...
91,196	Elmore's Patent Copper Depositing, 1 to 70,000	2	...	...	...	⅝— ¾	⅝— ¾	⅝	...
9,600*l*	Greenwood & Batley, 7 % Cum. Pref., 1 to 9,600 ...	10	7 %	7 %	...	10 — 12	10 — 12	...	...
15,000	Henley's (W. T.) Telegraph Works, Ord.	10	10 %	12 %	14 %	24½— 25½	24½— 25½	24⅞	24½
3,000	Do. do. do. 7 % Pref.	10	7 %	7 %	7 %	18 — 20	18 — 20	19	...
50,000	Do. do. do. 4½ Mort. Deb. Stock...	Stock	4½ %	4½ %	...	112 —115	112 —115	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	10 %	21 — 22	21 — 22	21 1/16	21¼
300,000	Do. do. do. 4 % 1st Mort. Debs.	100	...	...	...	101 —105	101 —105	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	2⅞ %	3½ %	3½ %	8½— 8¾	8½— 8¾	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	14 — 14½	13¾— 14¼	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	37 — 41	38 — 42	38½	...
150,000	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	...	...	...	105 —108	103 —106 xd	103	...
13,400	Telegraph Manufacturing, Ord. Nos. 6,601 to 20,000 ...	5	...	...	...	9¼— 9¾	9¼— 9¾	...	...
13,400	Do. do. 5% Cm. Prf. Nos. 6,601 to 20,000	5	...	...	...	5⅞— 6¼	5⅞— 6¼	...	...
540,000*l*	Waterloo and City Railway, Ord. Stock	100	...	...	3 %	104 —107	104 —107	105	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid.
Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

*Birmingham Electric Supply, Ordinary £5 (fully paid) 10½.
British Aluminium, Ordinary, 10½—11⅛; 7 % Pref., 11½—12½.
House-to-House, 4½% Debentures of £100, 105—108.
Kensington and Knightsbridge Electric Lighting, Ordinary Shares £5 (fully paid) 12½—13½; 1st Preference Cumulative 6%, £5 (fully paid), 7⅞—8¼. Debentures, 104—107. Dividend, 1898, on Ordinary Shares 10%.
National Electric Free Wiring, 10s. paid, 5/16—7/16.
Smithfield Market Electric, 3—4.
*T. Parker, £10 (fully paid), 18.

* From Birmingham Share List.

Bank rate of discount 3 per cent. (February 2nd, 1899).

MARKET QUOTATIONS, Wednesday, July 5th.

CHEMICALS, &c.	This week.	Last week.	Increase or Decrease.
a Acid, Hydrochloric .. .. per cwt.	5/-	5/-	..
a " Nitric .. .. .. per cwt.	22/-	22/-	..
a " Oxalic .. .. .. per cwt.	32/-	32/-	..
a " Sulphuric .. .. .. per cwt.	5/6	5/6	..
a Ammoniac, Sal .. .. .. per cwt.	37/-	37/-	..
a Ammonia, Muriate (crystal) .. per ton	£26	£26	..
a " " .. .. per ton	£24	£24	..
a Bleaching powder .. .. per ton	£5 15	£5 15	..
a Bisulphide of Carbon .. .. per ton	£15	£15	..
a Borax .. .. per ton	£16 10	£16 10	..
a Benzole (90 %) .. .. .. per gal.	7/-	7/-	..
a " (50/90 %) .. .. .. per gal.	5/6	5/6	..
a Copper Sulphate .. .. .. per ton	£27	£27	..
a Lead, Nitrate .. .. .. per ton	£23 10	£23 10	..
a " White Sugar .. .. .. per ton	£31	£31	..
a " Peroxide .. .. .. per ton	£27 10	£27 10	..
a Methylated Spirit .. .. .. per gal.	2/9	2/9	..
a Naphtha, Solvent (90 % at 160° C.) .. .. per gal.	5/6	5/6	..
a Potash, Bichromate, in casks.. per lb.	3½d.	3½d.	..
a " Caustic (75/80 %) .. per ton	£24	£24	..
a " Bisulphate .. .. per ton	£35	£35	..
a Shellac .. .. per cwt.	68/-	68/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers .. per ton	£6 5	£6 5	..
a " Recovered .. .. per ton	£5 10	£5 10	..
a " Lump .. .. .. per ton	£5 0	£5 0	..
a Soda, Caustic (white 70 %) .. per ton	£7 10	£7 10	..
a " Crystals .. .. .. per ton	£8	£8	..
a " Bichromate, casks .. per lb.	2¾d.	2¾d.	..
METALS, &c.			
b Aluminium Wire, in ton lots .. per ton	£294	£294	..
b " Sheet, in ton lots.. per ton	£191	£191	..
p Babbitt's metal ingots .. .. per ton	£65 to £137	£65 to £137	..
c Brass (rolled metal 2" to 12") basis per lb.	8¼d.	8¼d.	..
c " Tube (brazed) .. .. per lb.	10½d.	10½d.	..
c " Wire, basis .. .. per lb.	8½d.	8½d.	..

METALS, &c. (*continued*).	This week.	Last week.	Increase or Decrease.
f Ebonite Rod .. .. .. per lb.	8/-	8/-	..
f " Sheet .. .. .. per lb.	5/-	5/-	..
g Copper Bars .. .. .. per ton	£86	£86	..
g " Wire (basis price) .. per lb.	10½d.	10½d.	..
g " Sheet .. .. .. per ton	£86	£86	..
g " Rod .. .. .. per ton	£86	£86	..
n German Silver Wire .. .. per lb.	1/6	1/6	..
h Gutta-percha, fine .. .. per lb.	6/-	6/-	..
h India-rubber, Para fine .. per lb.	4/0½ to 4/1½	4/1½	..
i Iron, Charcoal Sheets .. .. per ton	£18	£18	..
i " Pig (Cleveland warrants) per ton	69/1	66/-	3/1 inc.
i " Forgings, according to size per ton	From £11	From £11	..
i " Scrap, heavy .. .. per ton	50/- to 55/-	50/- to 55/-	..
i " Wire galvanised No. 8 .. per ton	£10 12 6	£10 12 6	..
g Lead, English Ingot .. .. per ton	£14 7 6	£14 7 6	..
g " " Sheet .. .. per ton	£15 7 6	£15 7 6	..
l Mica (uncut slabs 8" long) .. per lb.	6/8	6/8	..
m Manganin Wire No. 28.. .. per lb.	8/-	8/-	..
g Mercury .. .. per bottle	£8 5	£8 5	..
p Phosphor Bronze, plain castings per lb.	1/1 to 1/4	1/1 to 1/4	..
p rolled bars & rods per lb.	1/1 to 1/4	1/1 to 1/4	..
p " r'l'd strip & sheet per lb.	From 1/2½	From 1/2½	..
o Platinum .. .. per oz.	£3 10	£3 10	..
p Silicium Bronze Wire .. .. per lb.	10½d. to 1/1	10½d. to 1/1	..
i Steel, Magnet, acc'd'g to desc'p'n p. ton	From £15	to £40	..
i Steel, Magnet, in bars	£58	£58	..
g Tin, block .. .. per ton	£126 10	£120 10	£6 inc.
g " foil .. .. per lb.	1/6	1/6	..
n " wire Nos. 1 to 16 .. .. per lb.	1/7	1/7	..
p White Anti-friction Metals— "White Ant" brand .. per ton	£40 to £65	£40 to £65	..
j Yarns, Cotton, Single 10lb. bundles pr lb.	7½d.	7½d.	..
j " Best Flax, 6 lea. .. per lb.	4½d.	4½d.	..
j " Hemp, 3 ply 10 lbs. .. per lb.	3½d.	3½d.	..
j " " Russian, 10 lbs. per lb.	4½d.	4½d.	..
j " Jute, 180 lbs. rove .. per ton	£12	£12	..
j " Manila, 24 thread .. per ton	£32 10	£32 10	..
k Zinc, Sheet (Vielle Montagne bnd.) p.t.	£30	£30	..

Quotations supplied by
a Messrs. G. Boor & Co.
b The British Aluminium Company, Ltd.
c Messrs. Thos. Bolton & Sons.
d
e

Quotations supplied by
f The India-Rubber, Gutta-Percha, and Telegraph Works Company, Ltd.
g Messrs. James & Shakspeare.
h Messrs. Jackson & Till.
i Messrs. Bolling & Lowe.
j Messrs. Henry C. Yeo & Co.

Quotations supplied by
k Messrs. Morris Ashby, Limited.
l Messrs. Sanders, Wake & Co.
m Messrs. W. T. Glover & Co., Ltd.
n Messrs. F. Ormiston & Sons.
o Messrs. Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Company, Ltd.

MACHINE TOOLS.*

The importance of modern machine tools and labour-saving appliances is becoming sufficiently pronounced to demand serious attention; and an equal or greater interest is required of manufacturers who do not desire to be left behind in the ardent competition now prevailing. England, which was formerly the home of the machine tool, must look to its laurels and satisfy itself that its designs are equally efficient with those of its Continental competitors. It is true that a few English firms are keeping abreast of the times, but the number is regrettably small, as evidenced by the quantity of foreign tools imported into this country.

The existing high rate of wages, and the growing necessity for greater accuracy in manufacture, causes a demand for tools of a more elaborate and automatic character.

For the introduction and use of these modern appliances to the best advantage, the designing and construction of machine tools should hold a more prominent position in the training of superintendents and operators.

Only a few of the more important tools will be described in this paper, a sufficient number of examples of the more familiar tools being given by way of comparison.

Distinctive Features in Modern Tools.

Perhaps one of the most noticeable features of modern workshops is the much larger variety of tools employed, due to the specialisation of each elemental operation, which, in combination with the automatic character of the movements, results in marvellous accuracy and interchangeability of the productions.

The not infrequent English practice of using rough cast gear wheels (or at best emery cleaned) is supplanted by the adoption of machine cut wheels — in many cases cut direct from the solid.

The employment of ball bearings for machines having considerable end thrust (especially where sensitiveness is required) is growing more and more general. When first introduced they were regarded more in the light of a luxury, but are rapidly claiming for themselves the position of necessity.

Screw cutting arrangements of lathes have been greatly improved by the introduction of "nest" gearing, controlled by the simple manipulation of a lever on the front. The regulation of the feed (from a back shaft), worked by a lever in front, deprives the operator of all excuse for not employing the most economical speed. The hardening and grinding of important working parts is receiving an increased amount of attention.

Automatic machines, especially those of the capstan and wire feed type, have made great strides, and the introduction of an electric system of driving is another indication of modern practice.

The limits of space preclude reference to numerous other

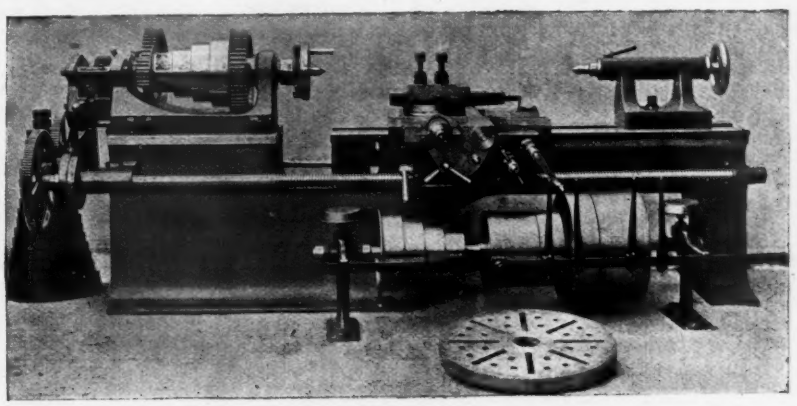


Fig. 1.

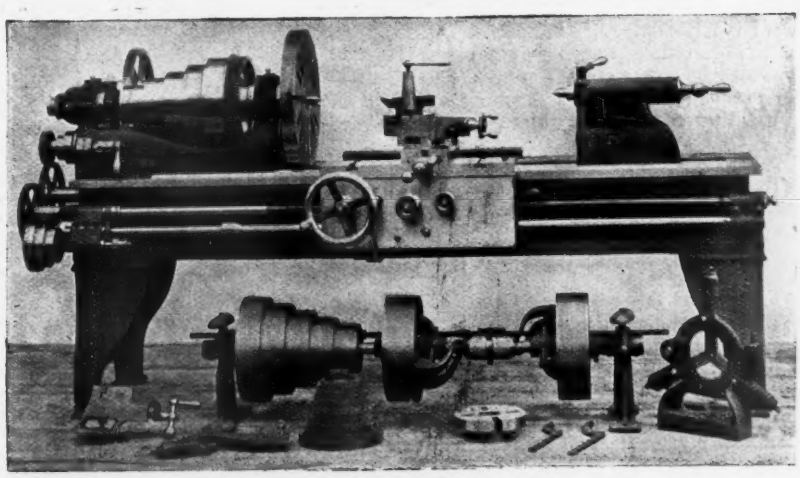


Fig. 2.

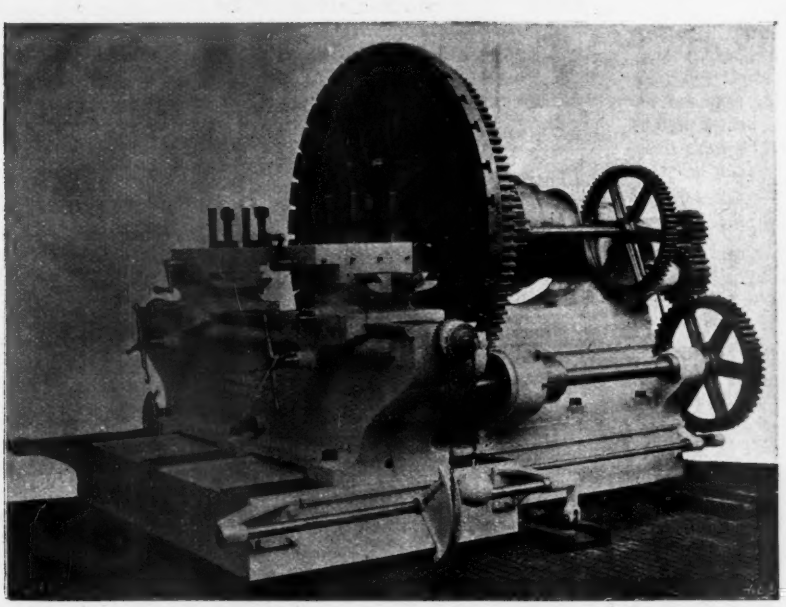


Fig. 3.

* Editorial abstract of a paper on "Machine Tools," by E. C. Amos, recently read before the Society of Engineers.

characteristics of the modern tool, which, judging by the present rate of progress, will itself, in the not distant future, become obsolete.

*Description of Tools.—*Lathes—Plain Types.*

In referring to lathes, the late Sir Joseph Whitworth should have special honour, owing to his having introduced the true elements of accuracy by means of universal gauges and threads, and the perfecting of the surface plate and measuring machine.

The following are among the essentials of a good modern lathe: (1) Hollow spindles; (2) Machine-cut wheels; (3) Hardened steel cones or bushes for fast headstock; (4) Turret-headed slide rests; (5) Friction clutches to back gear; (6) Sliding speed of saddle regulated by lever in front of lathe; (7) Ball thrust and other features mentioned elsewhere.

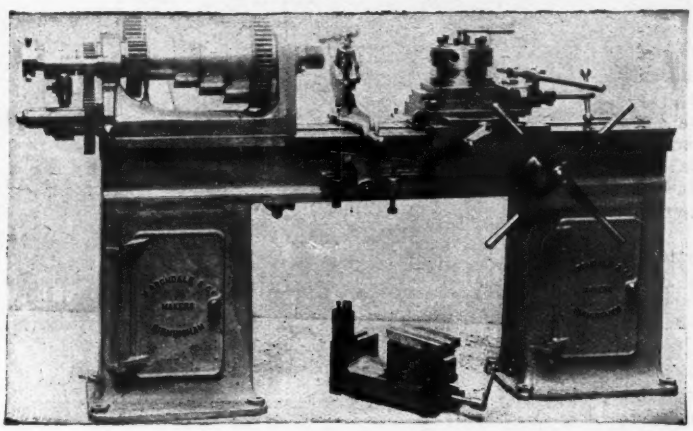


Fig. 4.

Light Screw-Cutting Lathes.

Illustrations, figs. 1 and 2, represent two types of lathes, the one English, the other American. The English is the stiffer of the two, greatly due to the box form of bed. The gap allows the employment of a larger face plate.

Heavy Screw-Cutting Lathe.

An example of heavy lathe by Messrs. Hulse was described, 5 cwt. of steel per hour being removed by this lathe, with a cut 1½ inch deep by ¼ inch thick.

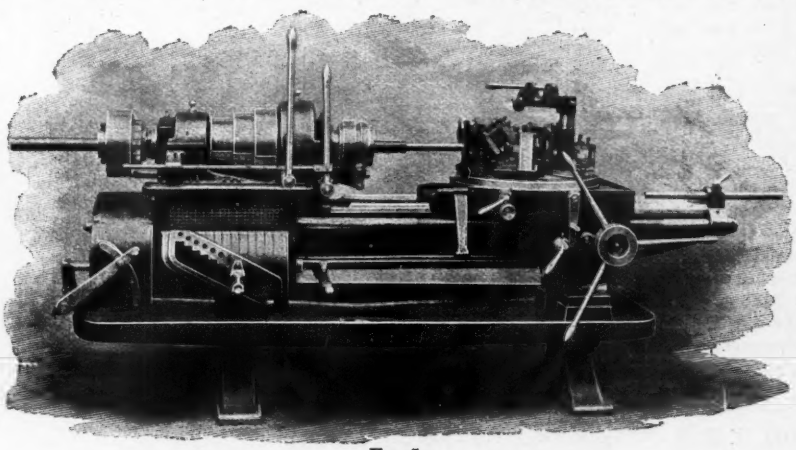


Fig. 5.

Heavy Face Lathe.

Fig. 3 represents a powerful Whitworth 8-foot face plate lathe, and is specially useful for turning large fly-wheels and pulleys, the hub being bored simultaneously with the turning of the rim.

Brass Finishers' Lathe.

Fig. 4 shows one of Archdale's brass finishers' lathes, having a 2-inch hollow spindle and 9-inch centres, with a six-tool turret and the cutting-off tool carried on the back of the cross slide. The chasing apparatus for external screws is worked from a master thread on the back shaft and has an improved arrangement for cutting taper threads. This tool is more substantial than its American *confrère*, one with a 6-foot bed weighing 1¼ tons.

Capstan Lathes.

This type of lathe, which has come so rapidly to the front during the last few years, is made in so many designs that it is difficult to know which particular pattern to select for description, and their appearance is so familiar that an illustration is not required. Those made by H. W. Ward & Co. are among the most up to date designs, and compare favourably with those produced in America, combining the best points of the two countries. The wire feed is a feature common to many capstan lathes, and merits a brief description, being the final adjunct necessary to complete the automatic character of the tool. It is an arrangement which provides for the feeding up of the work through the hollow spindle of the lathe. The operation is as follows:—The rod from which the finished articles are to be produced is placed through the hollow spindle and held in position by a self-centering gripping chuck, which is actuated by a lever at the back of the headstock; a sliding carriage produces a constant pressure against the rod by means of a weight. By releasing the lever, and thereby the work, the weight causes the rod to be pushed through the hollow mandrel any desired amount and regulated by a stop placed in the capstan rest. The rod is then gripped again, the next pin or stud (or other article being made) is cut off, and the process repeated. The whole operation is performed without stopping the lathe. When once set, the whole machine is entirely automatic, and boys, or even girls, with little technical experience are able to produce work from these lathes, which formerly required highly skilled labour.

Flat Turret Lathe.

Fig. 5 shows an automatic chucking and self-feeding flat turret lathe of very rigid construction, designed for producing from the bar extra long work of the stud and pin nature. The machine illustrated has 9-inch centres and weighs 2¼ tons, and has 40 feeds from 4 to 300 per inch. Work can be reduced 2 inches diameter at one cut.

(*To be continued.*)

* The scope of this journal only admits of a selection of the tools described and illustrated by the author, and it will be readily understood that this choice must be more or less arbitrary. The editor has been guided in his selection by considerations of novelty and general utility.

POWER TRANSMISSION BY DIRECT AND ALTERNATING CURRENTS.

This subject, which was revived by Mr. Swinburne at the Civil Engineers' Conference, has been so often threshed out that one would expect to find electrical engineers agreed upon, at least, the proper bases of comparison. To fairly compare rival systems of electrical power transmission, it is essential that the *efficiency* should be the same in each case—

otherwise one could prove any system whatever to be the best! Why, then, does Mr. Swinburne disregard this fundamental principle, and arbitrarily fix the current density? This, with a given cross section of copper, involves a fixed C^2R loss in the mains, no matter what power be transmitted by them; so that the *percentage* loss varies by as much as 200 per cent. in the cases considered by Mr. Swinburne.

This being so, the practical value of Mr. Swinburne's results is seriously discounted. We are glad to observe, however, that his calculations are based on the maximum, and not on the virtual, values of the pressure; this is so obviously the correct basis to take, that it is a matter for surprise that the contrary view should still receive support.

We have worked out the cases considered in the aforesaid paper, on the following bases:—*Weight of copper, efficiency of line, and stress on insulating material to be constant in all cases.* The results are given below:—

Case I.—One conductor to be earthed (at one point); pressure between any other wire and earth not to exceed V volts.

R = resistance of the conductors in parallel (a constant).
W = power sent into line.
w = power lost in line.
η = efficiency of line (a constant).
ϕ = power factor.
A = current in amperes on direct current system, Case I. (a constant).
A_1, A_2, A_3 = currents in amperes (virtual).

(*a*) Direct current with two wires; $\phi = 1$.
Resistance of one conductor = 2 R.
Current in one conductor = A.

$$w = 4\,A^2\,R. \qquad \eta = \frac{V - 4\,A\,R}{V}.$$
$$W = A\,V.$$

(*b*) Alternating current, one-phase, with two wires; $\phi = 1$.

Maximum pressure = V Virtual pressure = $\frac{1}{\sqrt{2}}$ V

Current in one conductor = A_1.

$$w = 4\,A_1^2\,R, \qquad \eta = \frac{V - 4\sqrt{2}\,A_1\,R}{V},$$
$$W = \frac{1}{\sqrt{2}}A_1\,V,$$

whence $A_1 = \frac{1}{\sqrt{2}}$ A, and W = 0·5 A V.

(*c*) Alternating current, two-phase, with four wires; $\phi = 1$.
Same as (*b*); W = 0·5 A V.

(*d*) Alternating current, two-phase, with three wires.
Common return conductor earthed. Maximum pressure between either lead and earth = V. $\phi = 1$.

Current in either lead = A_2. Virtual pressure = $\frac{1}{\sqrt{2}}$ V.
" in return = $\sqrt{2}\,A_2$.
Resistance of either lead = $(2 + \sqrt{2})$ R.
" of return = $(\sqrt{2} + 1)$ R.
Loss in leads = $2\,A_2^2\,(2 + \sqrt{2})$ R.
" in return = $2\,A_2^2\,(\sqrt{2} + 1)$ R.

$$w = A_2^2\,(6 + 4\sqrt{2})\,R. \qquad W = \sqrt{2}\,A_2\,V.$$
$$\eta = \frac{V - \frac{1}{\sqrt{2}}\,(6 + 4\sqrt{2})\,A_2\,R.}{V}$$

whence $A_2 = \frac{4\sqrt{2}}{6 + 4\sqrt{2}}$ A, and W = 0·69 A V.

(*e*) Alternating current, three-phase, with three wires; $\phi = 1$.
Maximum pressure between either insulated conductor and earth = V; therefore maximum pressure in one branch (star connection) = $\frac{1}{\sqrt{3}}$ V.

Virtual pressure in one branch = $\frac{1}{\sqrt{6}}$ V.
Current in each conductor = A_3.
Resistance of one conductor = 3 R.

$$w = 9\,A_3^2\,R.$$
$$W = \frac{3}{\sqrt{6}}\,A_3\,V. \qquad \eta = \frac{V - 3\sqrt{6}\,A_3\,R}{V},$$

whence $A_3 = \frac{4}{3\sqrt{6}}$ A, and W = 0·67 A V.

Effect of low power factor:—

Take (*b*) above, with power factor ϕ.

$$w = 4\,A_1^2\,R.$$
$$W = \phi\,\frac{1}{\sqrt{2}}\,A_1\,V. \qquad \eta = \frac{V - \frac{4\sqrt{2}}{\phi}\,A_1\,R}{V},$$

whence $A_1 = \frac{\phi}{\sqrt{2}}$ A, and $W = \frac{\phi^2}{2}$ A V.

In general, the power W corresponding with a power factor ϕ is found by multiplying the power found for $\phi = 1$, by ϕ^2, the efficiency being constant.

Case II.—Middle point of system earthed; pressure between any conductor and earth not to exceed V volts.

(*a*) Maximum pressure = 2 V.
Current in one conductor = 2 A (where A has the same value as in Case I.).
η is as before, and W = 4 A V.

(*b*) Maximum pressure = 2 V. Virtual pressure = $\sqrt{2}$ V.
Current in one conductor = $\sqrt{2}$ A.
η is as before, and W = 2 A V.

(*c*) Same as (*b*); W = 2 A V.

(*d*) As in Case I. W = 0·69 A V.

(*e*) Common junction earthed; $\phi = 1$.
Maximum pressure in one branch = V = max. pressure between any conductor and earth.
Virtual pressure in one branch = $\frac{1}{\sqrt{2}}$ V.
Current in each conductor = A_3.

$$w = 9\,A_3^2\,R. \qquad \eta = \frac{V - 3\sqrt{2}\,A_3\,R}{V}.$$
$$W = \frac{3}{\sqrt{2}}\,A_3\,V.$$

whence $A_3 = \frac{4}{3\sqrt{2}}$ A, and W = 2 A V.

Case III.—All conductors insulated; pressure between any two conductors not to exceed V.

(*a*) Same as Case I. W = A V.
(*b*) Same as Case I. W = 0·5 A V.
(*c*) Same as (*b*). W = 0·5 A V.
(*d*) Maximum pressure between leads = V.
" " in one branch = $\frac{1}{\sqrt{2}}$ V.
Virtual " " " = $\frac{1}{2}$ V.

$$w = A_2^2\,(6 + 4\sqrt{2})\,R, \qquad \eta = \frac{V - A_2\,(6 + 4\sqrt{2})\,R}{V},$$
$$W = A_2\,V,$$

whence $A_2 = \frac{4}{6 + 4\sqrt{2}}$ A, and W = 0·34 A V.

(*e*) Same as Case I. W = 0·67 A V.

The results are collected in the following table (No. I.), for a power factor of unity:—

Table I.—Power Factor Unity.

Current system.	No. of conductors.	Power transmitted.		
		Case I.	Case II.	Case III.
Direct	2	1	4	1
Alternating 1-phase	2	0·5	2	0·5
" 2 phase	4	0·5	2	0·5
" "	3	0·69	0·69	0·34
" 3-phase	3	0·67	2	0·67

In the case of an aerial line in good condition, the insulation resistance between any two insulated conductors would normally be twice that between any one conductor and the earth; hence Case II. would be the most appropriate arrangement for this purpose, as in this case the insulating material is stressed to approximately the same extent between line and earth as between the line conductors.

In the case of an underground line, with concentric cables, the stress on the insulating substance between the conductors is alone important, as the outermost may be earthed or not without effect on this stress; here Case III. is the proper basis of comparison.

Case I. may be applicable when for any reason Case II. cannot be made use of; this would, however, be exceptional.

Taking Cases II. and III., the following table (No. II.) shows the relative capabilities of the different systems with power factors, 0·9, 0·8, and 0·7—the power factor in the case of direct current being, of course, always unity :—

Table II.—Power Factor less than Unity.

Current system.	No. of conductors	Power transmitted.					
		Case II.			Case III.		
		$\phi = 0·9$	0·8	0·7	0·9	0·8	0·7
Direct	2	4	4	4	1	1	1
Alternating 1-phase ...	2	1·62	1·28	0·98	0·41	0·32	0·25
„ 2-phase ...	4	1·62	1·28	0·98	0·41	0·32	0·25
„ „ ...	3	0·56	0·44	0·34	0·28	0·22	0·17
„ 3-phase ...	3	1·62	1·28	0·98	0·54	0·43	0·33

Bearing in mind the fact that an alternating current circuit is always more or less inductive, the enormous superiority of the direct current system is very evident from these figures, quite apart from considerations of line capacity, dielectric hysteresis, &c., which are by no means negligible on long lines, especially if part of their length is underground.

The commutation difficulty, however, is still a fatal bar to the use of direct currents at extra high pressures, and since the power transmitted, other things being equal, is proportional to the square of the applied pressure, the alternating current of whatever description must always be preferred for long distance transmission. It is noteworthy that the two-phase system with *three* wires is hopelessly beaten in all cases; the three-phase system is, on the whole, the most advantageous.

If the problem be altered to that of finding the size of mains required to transmit a given power, the solution is easily obtained from the results given above. The simplest plan is probably to first calculate the size of mains required on the direct current system, with a suitable efficiency, at a pressure depending upon the current system to be employed, and the maximum stress permitted on the insulating material. The relative values of these pressures are given in the following table (No. III.) where v is the maximum stress pressure as defined in Cases II. and III., and v is the pressure in virtual volts between the line conductors in the various systems—excluding the two-phase three-wire system from the list as useless :—

Table III.

Current system.	Working pressure.	Max. stress V.		Equivalent d.c. pressure.	
		Case II.	Case III.	Case II.	Case III.
Direct	v.	0·5 v.	v.	v.	v.
Alternating 1-phase }	v.	0·71 v.	1·41 v.	1·41 v.	1·41 v
„ 2-phase }					
„ 3-phase	v.	0·82 v.	1·41 v.	1·63 v.	1·41 v.

The direct current mains are calculated for the pressure given in columns 5 and 6, according to the system adopted; the total cross-section of copper required for the mains on any other system is then obtained, by multiplying the value of the cross-section for direct current by the multiplier given in Table IV. for the corresponding system, allowing for the probable value of the power factor :—

Table IV.

Current system.	No. of conductors.	Multiplying factor.							
		Case II.				Case III.			
		$\phi = 1·0$	0·9	0·8	0·7	1·0	0·9	0·8	0·7
Altg. 1-phase }	2 }	2	2·5	3·1	4·1	2	2·5	3·1	4·1
„ 2-phase }	4 }								
„ 3-phase	3	2	2·5	3·1	4·1	1·5	1·8	2·3	3·1

The total cross-section divided by the number of conductors (column 2) gives the cross-section of each conductor.

Example.—To transmit 500 kw. (gross) 20 miles, on the three-phase system (Case II.), with 90 per cent. efficiency of line, maximum stress on insulation 5,000 volts, and power factor 0·9.

Here $v = \frac{5{,}000}{·82} = 6{,}100$ volts, and the equivalent D.C. pressure $= 6{,}100 \times 1·63 = 10{,}000$ volts. Drop in line $=$ 1,000 volts. Current $= 50$ amperes. Resistance of line $=$ 20 ohms. Total cross-section of copper $= 2 \times 0·09 = 0·18$ square inch. Cross-section of copper for three-phase system ($\phi = 0·9$) $= 2·5 \times 0·18 = 0·45$ square inch. Cross-section of each conductor $= 0·45 \div 3 = 0·15$ square inch.

THE ELECTROLYTIC METHODS OF ZINC EXTRACTION.

By JOHN B. C. KERSHAW, F.I.C.

The electrolytic methods of extracting zinc from poor or refractory ores have attracted considerable attention from metallurgists during the past ten years, and large sums have been expended in testing the more promising methods worked out in the laboratory upon an industrial scale. One or two of these have been successful, but the greater number have proved failures. Since there is a tendency in some quarters to regard the failures as exceptional and the successes as capable of repetition under altered conditions, it may prove useful to present to readers of the Electrical Review a summary of the processes which have received, or are now receiving, industrial trial; and also to quote some opinions relative to the economic aspects of the problem.

All the wet processes for the extraction of zinc from its ores by aid of electrolysis, are alike in the main features of the *modus operandi*. The roasted ore is leached, in special leaching vats or tanks, with a solution of some acid or salt, which is able to dissolve out the zinc. The resulting solution of zinc after purification is then electrolysed in a second series of vats, with or without diaphragms. The processes differ merely in the solvent used and in the details of the depositing vats.

The Ashcroft Process.—The solvent used in this process as originally tried at Grays, in Essex, and at Newcastle, in New South Wales, was a solution of a ferric salt. The zinc solution obtained, after removal of the iron, was then electrolysed in vats provided with carbon and iron anodes, and with zinc cathodes. Full details of the process, and of the plant erected at Cockle Creek in New South Wales, will be found in the Journals mentioned below.* After trials extending over several months in the years 1897 and 1898, at the last-named place, the process has been discarded. Mr. Ashcroft, in a paper read before the Institute of Mining and Metallurgy in June of last year, gave the three following as chief causes of this unfortunate ending to the trials :—

1. Falling off in the metal contents of the ore sent for treatment from the concentrating plant.

* *Journal Society of Arts.* Swinburne. Vol. 44. *Elektrochemische Zeitschrift.* Vol. 4, p. 189.

2. Inability to make the process truly cyclic in character, owing to the accumulation of manganese and other impurities in the electrolyte.

3. Insufficient financial support for maintenance of the work at Cockle Creek, upon the scale for which the plant had been designed.

The failure of this much-advertised process, for which a very large sum was paid by the Sulphide Corporation of London, has led to much mutual recrimination; and the failure will undoubtedly render it more difficult to raise money in this country for other electro-chemical or electro-metallurgical developments.

With regard to the second cause of failure mentioned above, it is not clear whether any difficulties from the accumulation of manganese had occurred during the earlier trials at Grays.

If such had arisen, it was certainly a grave error to erect plant upon a large scale at Cockle Creek before they had been overcome. If, on the other hand, manganese caused no trouble during the early experimental work at Grays, it would indicate that the ore sent over for treatment was not representative of the whole. As matters stand, the explanations given for the failure of the process are not completely satisfactory, and it is hardly surprising that the *Engineering and Mining Journal* of New York has expressed itself in strong terms upon the subject.*

The writer is informed that libel proceedings are threatened as a result of the remarks made in the issue referred to; consequently there is some chance of further light being shed upon the causes that led to failure.

The Dieffenbach Process.—This process uses as raw material a zinc-holding iron pyrites mined at Siegen, in Westphalia, containing 8 per cent. zinc before and 15 per cent. after roasting. The ore is crushed and is then roasted with common salt, in order to convert the zinc sulphide into chloride. It is then leached with water, and the resulting zinc chloride solution is electrolysed in specially designed vats, having a closed anode chamber. The chlorine obtained is, the writer believes, used for manufacturing bleaching powder. This process has been in industrial operation at Duisburg, in Germany, since 1895. In December, 1896, the works were stated to be producing 90 tons of zinc per month, and an enlargement was planned for 1897. Only ·50 per cent. zinc is left in the leached ore, and it is therefore available for use in the iron works of the neighbourhood. The zinc obtained by the process contains from ·02 to ·05 per cent. impurities —chiefly lead. Peters in a recent article,† however, states that the financial results of the Dieffenbach process are unsatisfactory, and that the zinc costs double that obtained by the ordinary distillation method. Borchers has still more recently stated that the works at Duisburg have stopped operations, but the cause of failure is not yet known.‡

The Siemens and Halske Process.§—This process was developed in order to meet the problem of the Broken Hill ores, and consists in leaching the roasted ore with a sulphuric acid solution, and in electrolysing the resulting acid zinc sulphate solution. The process is therefore merely a resurrection of the Letrange extraction process, tried on an extensive scale at St. Denis, with unsatisfactory results, some years ago. The electrolyte contains from 5—10 grammes per litre free sulphuric acid, and circulation in the depositing vats is promoted by means of air jets. Lead anodes and zinc cathodes are used. Experimental trials of this process at Berlin led to plant on a larger scale being erected for trial of the process at Lake Illawarra, N.S.W. These trials do not appear to have resulted in success, for the process which it is intended to work at Lake Illawarra is not an electrolytic one, but is dependent upon the precipitation of zinc as zinc oxide, from the zinc sulphate solutions, by means of magnesia. The Smelting Company, of Australia, are at present erecting a large plant for operation of this oxide process. A detailed description of the plant will be found in the issue of the *Engineering and Mining Journal* (New York), for September 17th, 1898.

The Nahnsen Procés consists in the use of a solution of the double sulphate of zinc and sodium as electrolyte, and it received trial at the works of the Schlesische Aktien Gesellschaft für Zinkhüttenbetrieb at Lipine, in Silesia, in 1893. The process was discarded because at that time no market existed for pure zinc. According to Nahnsen, 3 to 5 tons of coal will produce the electrical energy necessary to deposit 1 ton zinc by this process. The latest reports from Lipine are to the effect that the Nahnsen process is again in operation there, but no details are available.

The Hoepfner Process.—This process was first tried at Fuerfurth, in Germany, and it is now being worked upon an industrial scale in Germany, in Austria, and in this country at the Winnington works of Messrs. Brunner, Mond & Co. This firm produced 400 tons zinc by the Hoepfner process in 1897, while the works at Fuerfurth is said to have produced 800 tons in the same year. The electrolyte used is a solution of zinc and other chlorides—lead or sodium chloride. The cells are divided into anode and cathode compartments by diaphragms of special construction. The cathodes are rotating discs of zinc, only partly immersed in the solution. The anodes are of carbon or of lead. The rotating disc cathode is held by Hoepfner to be one of the chief features of the apparatus, since by its use treeing and other customary defects of electro-deposited zinc are avoided. The electrolyte is used warm. The method of preparation of the zinc chloride solution is not by any means clear. Schnabel states that it is obtained by leaching the ground and roasted ore with an alkaline solution; while, according to Steinhardt, it is prepared by mixing zinc sulphate solution with the calcium chloride liquors of the ammonia soda process.

In another account of the process*, lead chloride is substituted for calcium chloride, and lead sulphate is therefore obtained as a by-product, but the writer has not yet discovered how the lead chloride solution is originally prepared. Ingalls states that the output by this process is 5 kilogrammes zinc and 15 kilogrammes bleach per E.H.P. day. By a modification of his original process Hoepfner claims that he can produce 16 kilogrammes zinc per E.H.P. day, but in this case the chlorine liberated at the anode is used to raise an —ous salt to the —ic state of oxidation, and no bleach is therefore obtained. Borchers has recently stated† that the Hoepfner process has ceased operating at Fuerfurth; but this may be due to local or temporary causes, and in the light of a recent paper by Hoepfner‡ it is difficult to believe that the process has proved a failure.

(To be continued.)

* See issue for October 22nd, 1898.
† *Dingler's Polyt. Journal*, Vol. 309, p. 237.
‡ *Zeits. f. Elektrochemie*, March 2nd, 1899.
§ Patent No. 13,434. 1895.

FOREIGN ELECTRIC MACHINERY.

[COMMUNICATED.]

As the transmission of electrical energy from central stations becomes more and more universal, the nature of electrical engineering manufactures becomes correspondingly changed.

In early days the isolated electric plant was the backbone of the business; small firms all up and down the country made and installed complete plants, sometimes with and sometimes without the aid of a consulting engineer.

Nowadays isolated plants are confined to collieries and large factories, where, in fact, they are large enough to be classed among the smaller central station plants.

The demand for electro-dynamic machinery has of late set in more for dynamos of fairly large output, for the smaller consumer is better served from a central station in a town, and the large power user puts down a small central station of his own; hence dynamo-electric generators of smaller outputs are not now so much in demand as formerly.

The British makers have all along held their own in competition with the foreigner in the manufacture and installation of central station engines and dynamos, and those engaged in that branch of the business have prospered, and have still a bright future in view.

The smaller manufacturers have still left to them the motor business, but it is a branch of the business in

* *Zeits. f. Angew. Chemie*, 1899, p. 36.
† *Zeits. f. Elektrochemie*, March 2nd, 1899, p. 407.
‡ *Elektrotech. Zeitschrift*, November 3rd, 1898, p. 734.

which the foreign competitors are most successful, not because the foreigners make cheaper or better motors, but simply for the reason that they, especially the Americans, have made it their business to manufacture motors and their accessories which meet the requirements in distributing power in mills, factories, &c.

The small motor is the motor of the future. There is no gain in placing a few large motors in a factory to run all the shafting and belting as before. To effect a substantial saving, shafting and belting must be as far as possible abolished, and to accomplish this means a motor for every machine to be driven.

This system is succeeding here, and has for long been successful in America, one place in Washington having 400 motors at work, and we know an engineer in this country who, during the past 12 months, has put in over 150 motors in various places to displace mechanical distribution.

But most of the motors put in are American; the chief reason for the adoption of foreign motors in these cases is given without hesitation, as due to the fact that the machines required can be got promptly from stock; they are complete standard machines, reliable, and well tried.

The British maker has no stock; few of them even stock the materials; some of them take orders for machines for which they have not got out the drawings, the consequence is, that in the competition the American offers at the same price machines well known and tried, complete, ready for work from stock. The British maker wants time to make his plans, buy his material, and so on, until he makes an offer to deliver, say, 20 motors in six months. At the end of the six months, in all probability, he will ask to be excused, for the reason that he cannot get castings, or wire, or something. How can we expect to do business in that way? Motor making is pretty much like sewing machine making, it cannot be carried out successfully in a small shop with a few old-fashioned tools. A modern sewing machine could not be produced in a mechanic's shop for less than £100, while in a properly equipped factory put up for the purpose it could be made for £2.

British makers are still in the mechanic's shop stage; in most shops we find dynamos and motors of all sizes, shapes and designs being constructed, no regular manufacture, large firms competing for the equipment of an electric railway and for the supply of a motor to run a milliner's sewing machine, neither the milliner's motor, nor the electric railway plant being at the time in stock.

British makers only dabble in motor making; there is not a fully equipped motor factory in Britain turning out standard motors from ¼ to 10 horse-power as a speciality, and where we could wire for 20 motors to be delivered within a week. Yet there are several such places in America.

The excuse that they are all so busy that early delivery is impossible, is nonsense; a look through the shops at once reveals the fact that everything is being made to order, and the staff and tools are limited to the minimum required to complete the orders in about from three to six months over the time fixed for delivery.

These are the views of one whose business it is to buy and deal in dynamos and motors in Britain.

THE CALCIUM CARBIDE AND ACETYLENE GAS INDUSTRIES.

By JOHN B. C. KERSHAW, F.I.C.

I.—Production.

The production of calcium carbide in the electric furnace, and the utilisation of this carbide for the generation of acetylene gas, continues to be one of the favourite subjects for inventors, and the numbers of applications *granted* during the years 1896—1898 have been as follows:—

1896, 159; 1897, 172; 1898, 124.

The total for the latter year is not yet complete, and it is probable that ultimately the total of 1897 will be exceeded. For the first quarter of 1899, the number of patent applications granted has been 84.

In France, patent litigation has been commenced, and the Moissan patent is being contested by the Société de Froges.

In Germany, the Bullier patent of 1894 has been declared void. In this country the Bullier patent of 1895, is antedated by the Willson patents (16,342 and 16,705) of 1894. It is over these latter that litigation will occur, as several companies are manufacturing in defiance of the claims of those who have bought the Willson patents.

As the writer has often prophesied, carbide manufacture is not proving a very profitable industry for some of the companies floated in this country during the past few years. The Midland Acetylene Parent Syndicate, with works at Cradley Heath, has recorded a loss of £6,418 on the first 20 months' trading. The editor of the journal of the industry in a recent number,* refers to the injury resulting from the continued trading of *insolvent* carbide and acetylene companies. According to this writer, three companies in this country are being carried on by the debenture holders, unknown to the creditors. "They have not paid—nor do they intend to pay, a farthing of their existing liabilities." Another case of failure to realize the expected business or profits, is that of the Acetylene Gas Light Power and Calcium Carbide Company, which is being voluntarily wound up.†

These financial failures completely justify the opinions expressed by the writer in the past, upon the subject of the "boom" in acetylene gas company promotions, and they are the natural result of sinking excessive capital under unfavourable conditions in this new industry.

That cautionary remarks are not uncalled for is proved by the fact that since the commencement of 1898, 14 calcium carbide or acetylene gas company promotions have occurred in *this country*, the aggregate capitalisation of these companies being £543,100. In one of these prospectuses, the vendors, who are selling their patents in a new generator for £50,000, estimate the annual profits at £40,805. The shareholders will have considerable interest in checking these expectations at the close of the first year's operations.

The actual manufacture of carbide is believed to be carried on by six works in this country, but owing to the pending litigation, considerable secrecy is observed, and it is difficult to obtain reliable information on the subject. The six works alluded to, are situated at Foyers, Huddersfield, Sheffield, Birmingham, Cradley Heath, Ingleton, and Woodside in Surrey. As stated above, the Cradley Heath works has not so far operated at a profit.

With regard to the details of furnaces and methods of manufacture, a description of the generating machinery and furnaces at the new carbide works at Saulte Sainte Marie will be found in the paper named below.‡

Patten, in a recent article, has given details and illustrations of all the modern forms of carbide furnace.§ A recently published book‖ contains some notes upon the carbide works at Langenthal in Switzerland. The furnaces at this works are simple in construction, and are of the movable hearth type. Three-phase current is used, and three furnaces are worked simultaneously, each furnace taking current of one phase. The current used is 1,000—1,500 amperes at 75 volts. This is the first instance, so far as we know, of three-phase current being used for furnace work.

According to the *Electrician*¶ Lamoth and McRae, of Ottawa, have patented a new form of carbide furnace, in which carbon pencils connect the two electrodes. The heating is, therefore, effected chiefly by radiation from these pencils, and not by the arc.

Forty furnaces of this type are, it is stated, to be erected at Ottawa. The *Revue Industrielle* in a recent issue** describes a method for obtaining calcium carbide without the aid of electricity. The materials are to be prepared as at present, but with excess of carbon, and heated in a furnace supplied with pure oxygen obtained from the atmosphere by means of a Linde freezing machine. Patten, in a more recent article than that referred to above, states that multiple arc furnaces are now being used for carbide production.†† The latest form of carbide furnace, according to this writer, is 30 feet high, absorbs 1,000 amperes at 65—70 volts, and produces 1,500—1,800 lbs. carbide in four hours. The Bertolus furnace is said to be in use at Bellegarde, and is described in the paper named below.‡‡

The estimates of capital outlay and manufacturing costs still show considerable variation. A writer in *L'Industrie Electrochimique* gives an estimate of £32,000 for a plant of an annual capacity of 1,000 tons,§§ while another authority estimates the capital outlay as £35,000 for double this output of carbide. This writer estimates the working costs when steam-power is used at £23,000 per annum, when water-power is used, at £17,500 per annum, on an output of 7 tons carbide per day, 350 working days being taken as the basis of calculation.‖‖

As regards the actual yield of carbide, the writer just named states that 1 E.H.P. now yields 3·5 kgs. carbide per day of 24 hours, while Patten asserts that a yield of 4·3 kgs. per E.H.P. day,¶¶ is obtained in the United States. Haber, in his handbook on "Technical Electro-chemistry,"*** states that in Germany 3 kgs. per E.H.P. day of 24 hours are usually obtained, while in the United States the yield is increased by about 1 kg. The theoretical yield of carbide is 5·4 kgs. per E.H.P. day of 24 hours, so that the thermal efficiency of the process is about 65 per cent.

In a recent report††† the number of carbide works in operation was

* *Journal of Acetylene Gas Lighting*, January, 1899.
† The *Times*, April 13th, 1899.
‡ *L'Eclairage Electrique*, November 5th, 1898
§ *Electrical World*, November 22nd, 1898.
‖ "Une Excursion Electrotechnique en Suisse."
¶ *Electrician*, November 25th, 1898.
** *Revue Industrielle*, December 10th, 1898.
†† *American Electrician*, January, 1899.
‡‡ *Zeitschrift f. Angew. Chemie*, 1898, p. 1078,
§§ *L'Industrie Electrochimique*, September, 1898.
‖‖ *Elektro-tech. Anzeiger*, April 21st, 1898.
¶¶ *American Electrician*, January, 1899.
*** "Tech. Elektrochemie," chapter 10. Leipzig, 189
††† *Engineering*, December 9th, 1898.

given as 32, and the number of works building, as 18. To these totals must be added six others, so that at the end of the present year there may be no fewer than 56 works engaged in the manufacture of calcium carbide. The probability is, however, that some of the works now in operation, will have to cease production, owing to the difficulty of finding a market. No returns are yet available which will enable one to gauge accurately the production of carbide in Europe, or the present demand for carbide in connection with *bonâ fide* lighting developments.

II.—UTILISATION.

On the subject of generators for production of acetylene gas, Gerdes in Glaser's Annalen,* recommends those in which the carbide is wholly immersed. Lewes in Cantor Lecture III.† on acetylene gas, also advises the use of this form of generator, but states that a larger yield of gas is obtained from those generators in which the water slowly rises round the carbide. For ordinary use the latter form will, therefore, be preferred, although the gas obtained from it is less pure.

In a recent issue of the journal devoted to the calcium carbide and acetylene industry, the dangers arising from the use of faulty and badly designed generators are alluded to.‡

With regard to the properties of acetylene gas, there is little new to report. Redwood has published a note dealing with the injurious action of acetylene gas upon platinum, when used for heating purposes in the laboratory.§ Gerdes in Glaser's Annalen has reported the results of his experiments upon the poisonous and explosive properties of the gas. A summary of this paper will be found in the journal named below.‖

In the *Comptes Rendus* Claude gives details of his researches upon the explosive properties of acetylene gas at low temperatures.¶

The purification of acetylene gas upon a commercial scale, is a subject which is now attracting considerable attention. As already noted, generators in which the carbide is wholly immersed yield the purest gas, since the gas in bubbling up through the water is subjected to a washing action, and soluble impurities are thus removed. All other types of generator when worked with ordinary commercial carbide, yield very impure gas, and Stern has stated that none of the methods of chemical purification hitherto suggested or tried, have been completely successful.** A new method of purification, patented by Ullman, is described by the same writer. Chromic acid is the agent employed to absorb the impurities, and it is claimed for this new method, that all impurities can be removed in the one operation.

The use of acetylene gas as an illuminating agent in remote districts, where the cost of coal-gas is high, is slowly extending. Considerable attention is also being given to the use of mixtures of oil-gas and acetylene. In the recent Cantor Lectures on acetylene,†† Lewes gives details of his own experiments on this subject. With a mixture containing 22 per cent. acetylene the illuminating power is doubled. If oil-gas costs 6s. 6d. per 1,000 cubic feet, and acetylene 38s. to 40s. per 1,000 cubic feet in the gasometer (the estimate is based on carbide at £16 per ton at the factory), the addition will not be economical; but in those places where oil-gas costs more than 6s. 6d. per 1,000 cubic feet the use of acetylene will prove remunerative.

Details of the acetylene gas lighting plants at Wabash, Indiana, at New Milford, Connecticut, at Milford, Pennsylvania, and at Cowdenheath, Scotland, are given in a recent issue of the *Progressive Age*.‡‡ At the last named place, the users are not taking kindly to the increased cost (oil-gas was sold at 12s. 6d. per 1,000 cubic feet, while acetylene gas is charged 100s. per 1,000 cubic feet), though doubtless they appreciate the improved illumination. In a paper recently read by Vertus before the K. Ungar Naturwiss, Verein, in Buda-Pesth,§§ the author discussed the use of the gas as an illuminant, and stated that its chief service would be as an enricher for gases of lower illuminating power.

Prof. Thompson, in a short series of lectures delivered at the Finsbury Technical College in 1897, in fact stated that in the States, acetylene was being used for this purpose in nearly every gasworks. The statement has, however, been contradicted by a writer in the *Electrician* as regards the gasworks of the Eastern States.‖‖ Bork, in the paper named below,¶¶ has published details of the costs of definite mixtures of oil gas, and acetylene. Worked out to a common basis of comparison, the mixed gas is only one-half the cost of the oil-gas alone. It must be remembered, however, that in actual practice, the gain is not in cost, but in increased illumination; the tendency with a cheaper illuminant always being to increase the light rather than to reduce the cost. A good general article on the use of acetylene as a lighting agent appeared in a recent issue of the *Engineer*.*** This article is worthy of attention since it is singularly free from the extravagance which usually marks articles written in favour of the new illuminant.

With regard to the use of acetylene in gas engines, Grover has recently issued a pamphlet containing the results of his own experiments upon this subject.*

In a letter to one of our contemporaries Grover states that in his opinion there will be a great future for acetylene motors when calcium carbide sells for £5 per ton.† This, we are afraid, is tantamount to "never."

This present article can be fittingly concluded by a list of places in this country at which acetylene lighting plants are being installed. Some of these are, doubtless, now in operation:—

Barnton; North Cave; Needwood House, N.B.; Lochalsh pier and station; Osberton Hall, Worksop; Volunteer Hall, Lochgilphead; Golf Club House, Burntisland; Free Church, Montrose; Y.M.C.A., Grantown-on-Spey; shops at Crowdenheath, N.B.; and railway station at Abboyne.‡

* *Engineering Magazine*, December, 1898.
† *Journal Society of Arts*, January, 1899.
‡ *Journal of Acetylene Gas Lighting*, January, 1899.
§ *Journal Society Chemical Industry*, December, 1898.
‖ The *Engineering Magazine*, December, 1898.
¶ *Comptes Rendus*, January 30th, 1899.
** *Journal of Gas-beleuchtung*, Vol. 41, p. 749.
†† *Journal Society of Arts*, January 13th, 1899.
‡‡ *Progressive Age*, December, 1898
§§ *Chemiker Zeitung*, December 12th, 1898.
‖‖ The *Electrician*, January 7th, 1899.
¶¶ *Le Genie Civil*, November 5th, 1898.
*** The *Engineer*, March 31st, 1899.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS.—1899.

Compiled expressly for this journal by W. P. THOMPSON & Co. Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester, and Birmingham, *to whom all inquiries should be addressed.*

12,706. "Electric muscular exerciser." A. B. MACMILLAN. Dated June 19th. (*Complete.*)

12,730. "Improved galvanic cell." P. OFFENBROICH and H. ROCKEL. Dated June 19th.

12,731. "Improvements in electrical switches, particularly suitable for high voltage connections." G. W. HOLT and A. ATHERLEY. Dated June 19th.

12,732. "Improvements in electrical switches." G. W. HOLT and A. ATHERLEY. Dated June 19th.

12,750 "Improvements in or relating to electric traction systems." E. CERVENKA and S. MAHLER. Dated June 19th. (*Complete.*)

12,757. "An improved current-collecting brush for electro-motors, dynamo-electric machines, and the like." I. LANDAUER. Dated June 19th.

12,761. "Improvements in automatic charging apparatus." C. D. ABEL. (A. B. Helbig and P. C. F. Hemmore, Germany.) Dated June 19th.

12,767. "Improvements in and connected with coin freed electricity meters" F. J. BEAUMONT. Dated June 19th.

12,772. "Improvements in electrical resistance baths." W. C. SELLAR. Dated June 19th.

12,787. "Improvements in devices for breaking electric circuits and protecting the same from excessive currents." W. P. THOMPSON. (The Rolfe Electric Company, United States.) Dated June 19th.

12,788. "Improvements in and relating to carbon conductors for electric cells and dynamos." C. W. HERTEL. Dated June 19th.

12,789. "Improvements in telephone systems." R. WIENMAR. Dated June 19th.

12,800. "Improvements in or appertaining to certain multiple safety fuse blocks for electric light wires and other similar electric conductors." M. H. BARBER. Dated June 20th.

12,829. "Improvements in obtaining metals from their fused ores oxides and salts by electrical action." J. BAXERES DE ALZUGARAY. Dated June 20th.

12,833. "Improvements in filaments for electric glow lamps.' G. BAMBERG. Dated June 20th.

12,842. "Improvements in electrostatic measuring instruments." THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED. (E. Thomson, United States.) Dated June 20th. (*Complete.*)

12,869. "Improvements in driving mechanism for dynamos." W. L. BLISS. Dated June 20th. (*Complete.*)

12,874. "Improvements in glass globes, screens, covers, or like for electrical incandescence and other lamps, and in means for manufacturing the same." E. APPLEGARTH. Dated June 20th.

12,883. "A method of repairing incandescence electric lamps." M DUMONT. Dated June 20th. (Date applied for under Patents, &c., Act, 1883, Section 103, April 12th, 1899, being date of application in France.)

12,904. "Improvements in working changing colours for advertising signs, electrical effects and the like." G. F. KENYON and W. H. BLACKHURST. Dated June 21st.

12,949. "Improvements in or relating to the connection of house service or branch conductors to electric mains." L. ANDREWS and J. GLASS. Dated June 21st.

12,951. "Improved cut-out apparatus for automatically disconnecting incandescence lamps having filaments of secondary conductivity." W. P. THOMPSON. (The Vereinigte Electricitäts-Actiengesellschaft, Austria-Hungary.) Dated June 21st. (*Complete.*)

* *Engineering*, December 9th, 1898.
† The *Engineer*, February, 1899.
‡ *Journal Acetylene Gas Lighting*, January, 1899.

12,956. "Improvements in electric furnaces." La Compagnie Electro-Metallurgique des Procedes Gin et Leleux. Dated June 21st. (Date applied for under Patents, &c., Act, 1883, Section 103, January 27th, 1899, being date of application in France.)

12,959. "Improvements in or relating to electric motors." G. Verbeckmoes and P. Caibe. Dated June 21st.

12,961. "Improvements in and relating to methods of controlling electrically propelled vehicles." P. W. Northey and The Electric Motive Power Co., Ltd. Dated June 22nd.

12,962. "Improvements in electrically propelled vehicles." P. W. Northey and The Electric Motive Power Co., Ltd. Dated June 22nd.

13,008. "Improved apparatus for converting alternating currents into continuous current." M. Deri. Dated June 22nd. (*Complete.*)

13,018. "Improvements in electric arc lamps." J. B. Barton and J. M. Gorham. Dated June 22nd.

13,054. "Improvements in holders for globes and shades of gas, electric, and other lamps." G. F. Sanders. Dated June 23rd.

13,062. "Improvements in and relating to incandescent electric lamps." H. S. Cowx. Dated June 23rd.

13,074. "Improvements in apparatus for electrolysis." P. Schoop. Dated June 23rd.

13,076. "Improved troughing for electric cables." G. Sutton. Dated June 23rd.

13,088. "Improvements in electric tramways or railways." B. J. B. Mills. (E. Bonnet, J. Paufique, and G. Liniere, France.) Dated June 23rd.

13,105 "Improvements in electric arc lamps." The Gandus Arc Lamp and Electric Co., Ltd., and A. D. Jones. Dated June 23rd.

13,111. "Improvements in and connected with electrical switches." E. J. Wade and The Electric Motive Power Company, Limited. Dated June 24th.

13,117. "An improved magnetic motor." B. Draper, W. Bayliff, and T. D. Bayliff. Dated June 24th.

13,118. "Improvements in mechanism for electrically driving Roots and like blowers." A. D. Ellis and W. B. Crichton. Dated June 24th.

13,133. "Improved means of cooling enclosed electric motors or dynamos." W. Hartnell. Dated June 24th.

13,136. "Appliance for telephone pay stations." J. E. Kingsbury. (The Western Electric Company, United States.) Dated June 24th.

13,138. "Improvements in the construction of cores in electrical cables." C. C. Sonne and K. Gulstad. Dated June 24th.

13,144. "Improvements in or relating to flash light telegraphing or signalling apparatus." J. Stewart. Dated June 24th.

13,167. "An improved electric condenser and the application of the same in combination with electrical devices or machines." S. Frizzoni. Dated June 24th.

13,174. "Improvement in electric signalling apparatus." F. B. Herzog. Dated June 24th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, Manchester, and Birmingham, *price, post free,* 9d. (*in stamps*).

1897.

21,157. "Magnetic and electrical measuring instruments." J. Russell. Dated September 15th, 1897. Relates to current and energy meters, magnetic measurements. The current passes through four stationary rectangular coils. Two of these are arranged vertically, and produce a uniform horizontal field; the other two are connected so that the current flows in the same direction in all the adjacent wires in the middle. These wires are magnetically shielded to some extent by surrounding iron, which is carried by a balanced frame, and can move vertically to some extent. The balance is provided with movable weights to measure the effect of the current on the iron. The windings may be modified for use of the instrument as a voltmeter or wattmeter, with continuous or alternating currents. The iron may be in thin strips bent into U-form, and placed together from above and below the balance frame, with insulation interposed between the overlapping limbs. The instrument may be used for observation of the properties of different specimens of iron, and may be provided with current reversing and regulating switches. The iron may be stationary and the coils movable, in which case these coils may be enlarged to enclose the stationary coils. The coils may be replaced by other means for the production of a uniform magnetic field. The parts may be duplicated at the ends of the frame, so that the instrument may be used to balance the effects of two specimens of iron, one of which may be a standard piece. The balance may be replaced by a part hung by a torsion wire. In the form described a single coil of D form in plan is used. The coils are circular, the torsion wire being placed axially in them. The wire carries a short straight tube enclosing a straight part of the coil, and carrying a pointer. Two iron specimens may surround the ends of this tube, when the difference of their magnetic effects is to be observed; or iron may be placed on one end only. In a modification of this instrument the coils are modified to act in the same direction on iron at both ends of the tube. For measurements of large currents, thick strips may be used instead of wire coils. The current supplied through a conductor at some distance behind the front portion divides through two strips; the current from the part passes through a horizontal semi-circular part, a vertical part, another semi-circular part, and a vertical part; the current from the strip passes through parts symmetrical with these. The four semi-circular parts replace the coils, and the vertical parts the coils, and they act on iron pieces carried by a support hung by a torsion wire. The support may carry a damping vane in a vessel of oil. The method of using conductors partly shielded magnetically may also be applied in sensitive galvanometers and other modifications of the instrument described. 2 claims.

21,195. "An improved continuous current dynamo-electric machine." A. E. Badger. Dated September 13th, 1897. A dynamo for generating constant continuous currents of low electromotive force but considerable current strength, is composed of a bell-shaped field magnet, provided with a central core carrying the winding, and an annular armature carrying a number of longitudinal conductors. The conductors are connected at their two ends to collecting rings, upon which bear brushes connected together and to the terminals in the manner shown. Instead of employing a series of armature conductors, the currents may be generated in the armature body, which in this case is furnished at each end with a single collecting ring. 3 claims.

21,410. "Improvements in transformers, impedance coils and the like." W. E. Bornard. Dated September 18th, 1897. Inductive appliances, such as transformers and impedance coils, have a regular rectangular or similar magnetic circuit with windings on all four sides. 3 claims.

21,484. "Improvements in electric motors." W. R. Lake. (R. Arno, Italy.) Dated September 18th, 1897. Motors, alternating current. An asynchronous monophase alternating current motor is provided with only one coil or set of coils on the field magnet or stator, to which the alternating current is supplied, and the motor is started by inserting an additional resistance into the closed coil armature or motor, and giving the latter a small initial impulse. A bipolar motor having one pair of coils in the stator and a three-phase armature winding connected by brushes with resistances, capable of being thrown into or out of circuit by means of a switch, is described. The initial impulse may be obtained by keeping open one of the armature coils at starting, which may be done by arranging the starting switch so that the contacts in connection with that coil are brought together a little after the contacts. Should the armature be at a dead point, a second coil is opened by a switch. 2 claims.

21,496. "An electrical water level indicator or recorder." P. R. Cobb. Dated September 20th, 1897. Relates to apparatus for indicating at a distance, electrically, the variations of liquid level. The drum is turned backwards and forwards with the rise and fall of the liquid by means of a cord and float and a cord and counterweight. One of a series of pins is thus brought into contact with a lever (one such lever being arranged at each side of the drum), and raises and depresses it. The depression has no effect, the connected spring simply giving a little until the pin slips past the lever. But when the lever is raised against the action of the spring, it ultimately slips over the pin, and the spring in the return movement, which is controlled by a dash pot, makes a temporary contact with the next pin, and closes circuit for a split battery through the electro-magnet of the receiver. A current is thus sent through the electro-magnet in a direction dependent upon the direction of motion of the drum. The electro-magnet has four poles. Two polarised armatures (with like poles turned the same way) are provided and each armature carries a detent arm, which, engaging with a pin on a disc, prevents its rotation under the influences of a cord and weight. By this arrangement, whenever a current passes in either direction through the magnet, one only of the armatures is attracted, and releases its disc. The disc turns through half a revolution, and one of its pins, engaging a toothed wheel, rotates this wheel, and with it the index finger of the receiver, through a small angle. Instead of an indicator, a recording pin may trace a diagram of the variations of level on a drum. 3 claims.

22,215. "Improvements in alternating current energy meters." The British Thomson-Houston Company, Limited. (R. Shand, United States.) Dated September 28th, 1897. Energy meters for alternating currents in circuits which may be inductive. An armature with retarding and registering mechanism of any desired construction is driven inductively by a current coil, C, and potential coils c^1, c^3. The coil C carries the main current, or a definite fraction of it. The coil, c^1, is connected in series with an inductance coil, c^2, across the mains. The coil c^3 is supplied by the secondary of a transformer T, the primary of which is also connected across the mains. The currents in c^1, c^3 thus differ in phase nearly 90° and 180° respectively from that in C; the dimensions are made by trial or experiment, such that the coils c^1, c^3 together are equivalent to a coil carrying a current in quadrature with the electromotive force on the mains. In a modification, one end of the transformer primary may be connected to a point on the inductance coil, c^2, as indicated in dotted line. In an actual meter the coils c^1, c^3 may be wound together and enclose the armature in a plane at right angles to the coil C. 3 claims.

22,610. "A new or improved compound or material applicable for electrical or heat non-conducting or insulating purposes." H. J. Brown, O. B. H. Schmidt, and A. Mackenzie. Dated October 2nd, 1897. Insulating compositions or materials for electrical and other purposes, such as non-conducting coverings for steam boilers, consists of mixtures of finely divided or disintegrated mica and silk, either felted together or mixed with a cement such as resin, pitch, or shellac. The material may be formed to any desired shape or may be applied directly to electric conductors. 1 claim.